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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

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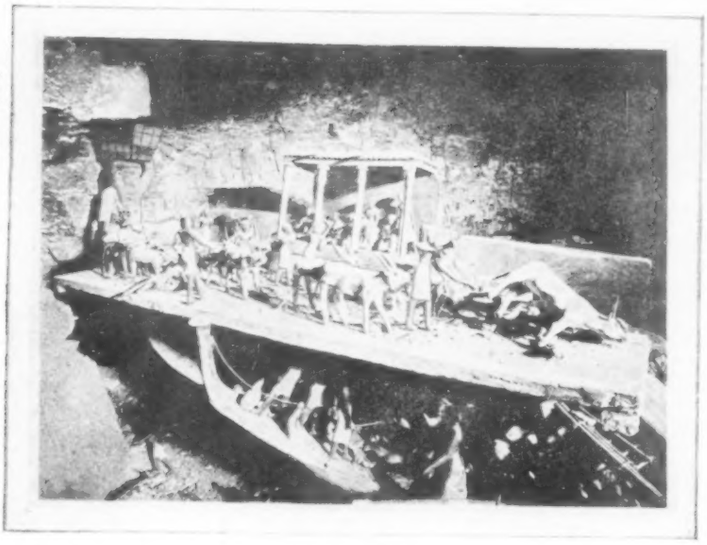
Lacquering — *an art that was never lost*



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THE
METAL INDUSTRY
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THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Vol. 21 NEW YORK, JULY, 1923 No. 7

American Electro-Platers' Society Convention

Eleventh Annual Convention Held in Providence, R. I., July 2-5, 1923

Written for The Metal Industry by WILLIAM H. MASON, Providence, R. I.

The delegates began to arrive late Sunday afternoon and Monday morning's trains and boats brought large additions to the early comers. But the members of the reception and entertainment committees of the Providence-Attleboro branch, as well as the Ladies' Auxiliary headed by **Mrs. John E. Garrick** of Attleboro, were on the alert and ready to greet each visitor as they put in an appearance at the hotel and to take the ladies in charge and see that everything possible was done for their comfort and convenience.

J. E. STERLING,
President

The arrivals during the hours just preceding the opening of the session were constant and from the outset gave indications of being one of the best attended conventions of the Society. Monday morning was devoted entirely to registration, assignment to reservations and an informal get-together in the ballroom foyer. Here the officials of the National Society, as well as of the Providence-Attleboro branch, were busily engaged in the necessary clerical work and making the final preparations for the convention itself. But so well had the plans been systematized that there was no hitch or delay in caring for the delegates or moving the big convention along its road toward a successful end.

OPENING SESSION AND GREETINGS

The opening session occurred at 2 o'clock Monday afternoon, being called to order by **Supreme President Walter J. Allen,** of Detroit, Mich., who gave a cordial greeting to his associates, expressed his pleasure at the unusually large number for the opening session and congratulated the Providence-Attleboro committee and the New England branches on the very auspicious opening of the eleventh annual national convention and the promising programme that had been prepared. He then introduced **Hon. Joseph H. Gainer,** Mayor of Providence, who delivered the address of welcome for the city to the Society.

Mayor Gainer in extending the welcome of the city of Providence, called attention to the fact that there are many reasons why a convention like the Electro-platers should select Providence as a place for its annual meeting, principally because of the large number of manufacturing jewelry concerns in this city and the adjoining Attleboros, which furnish the major portion of employment for the electro-platers in this section. Then there are the other industrial places of interest to be visited, as well as the educational, historical and scenic features.

The delegates were then welcomed on behalf of the Providence Chamber of Commerce by **H. Nelson Street,** secretary of the Chamber's convention committee which has given the local committee every possible indorsement and assistance in connection with the bringing of the convention to Providence and its entertainment. Mr. Street made an interesting and instructive address upon matters pertaining to the historical places in and about Providence and briefly outlined some of the various points that has made Providence famous or pre-eminent in the industrial, commercial, educational or social world.

E. J. MUSICK,
First Vice President

Woodward Booth, manager of the New England Manufacturing Jewelers' and Silversmiths' Association, extended a welcome on behalf of the great industry which he represents — the fifth largest in point of number of concerns engaged in the business, amount of capital invested and value of production in Rhode Island and representing one of the largest jewelry manufacturing centers in the world. He said that the manufacturing jewelers of this section are vitally

interested in everything that pertains to the electroplating business and expressed himself as greatly pleased at the opportunity of extending the greetings of the association which he represented and the welcome of the hundreds of firms and thousands of employes which his association represented and expressed the hope that the convention would prove successful and satisfactory from every possible point of view.

The welcome of the Providence-Attleboro Branch was extended through its honorary president, **Albert W. Claflin,** A.B., Phar.D., of this city, who said that the local society appreciated the high honor that had been accorded it in being privileged to welcome the national convention within its borders and expressed the pleasure he had in seeing so large a number at the initial gathering. He said that Rhode Island may be small territorially, but its heart was big and its greeting cordial.

F. W. WOODMANSEE
Second Vice-President

Charles H. Proctor, of New York, as founder and first Supreme President of the society, and Past Supreme President **Walter Fraine** of Dayton, O., responding to the addresses of welcome expressed the pleasure of the members and guests in coming to New England and especially to Providence.

Following the addresses, the convention took up its regular schedule of business, seating delegates upon the report of the credential committee which had been busy during the forenoon in recording and tabulating the representatives from the several branches, and the organization of the special and standing committees for the convention.

In the evening **Walter J. Allen,** of Detroit, delivered his annual address as Supreme President, the keynote of which was an appeal for a greater appreciation of the work which the Society is accomplishing and asked that the active membership be made something more than membership in name only. He said that it was regrettable that the manufacturer is not sufficiently cognizant of the work that the Society is doing and has been doing ever since its inception; that the manufacturer has been slow in recongnizing the value and importance the Society's work is to his business and he expressed the hope and belief that it would not be long before the "deserved" recognition would be extended. Once secure this recognition, said President Allen, and the support and assistance of the manufacturer is not only assured but will be overwhelming.

President Allen said that it is also regrettable that the general public does not have a clearer understanding of what our Society represents and what it is striving to accomplish; to realize that it is an educational association whose aim is the improvement of its individual members and the improvement of the industry itself. He declared that he believed that a mistake had been made in naming the organization, but he predicted that the immediate future would see the expansion of the association's programme and the inclusion in its membership of representatives of foreign nations, thereby making it an international rather than a national body.

During his talk, President Allen drew a comparison between the practical working chemist and the technically trained chemist. He said that he was positive in his belief that practicability in the active member was absolutely essential from the fact that the chemist needed first to be practical and afterwards technical.

Dr. Colin G. Fink, of Columbia University, secretary of the American Electro-Chemical Society, brought the greetings of that body to the convention and delivered a technical address on "Electro-Chemistry and Electro-Plating." This was followed by an address by **Dr. William Blum,** of the United States Bureau of Standards, the subject of his address being "The Bureau of Standards and the Electro-Plating Industry."

RECREATION ON JULY 3

Tuesday had been set apart in the programme as a day of recreation with the scene of the festivities at Newport, the famous summer playground of fashion and society, the world-renowned "City-by-the-Sea." But the edicts of the weather man had not been reckoned with and a heavy rain interfered with the carrying out of the plans that had been scheduled by the committee. In taxi-cabs, under the shelter of umbrellas or the protection of "slickers," the entire party wended their way from the hotel to the steamboat landing where the big side-wheeler Mount Hope was in waiting to transport the excursionists on a thirty-mile sail down Narragansett Bay.

Although the steadily falling rain imprisoned the party within the saloon decks, the visitors were af-

DELEGATES AND VISITORS AT THE ELEVENTH ANNUAL CONVENTION
As this picture was taken during the rain it

forded sufficient glimpses of the beauties of Rhode Island's great waterway to appreciate that the much tooted scenic attractions are fully merited. Two hours on the boat brought the voyagers to Newport where special trolley cars speedily took the party to the beach, where many of them had their first experience in viewing "Old Ocean," its white-crested waves pounding in upon the sands with a roar like reverberating thunder. Here also a large number had their first experience with a Rhode Island shore dinner, and to some this experience was far from inspiring although everyone made a kindly attack upon the succulent sea-food spread in abundance before them.

The committee, desirous of deviating as much as possible from the customary field day programme with its proverbial baseball game, had planned a very elaborate schedule of water and other seaside events, but the rain prevented the carrying of this programme into effect. But the long drive along Newport's famous waterfront for upwards of twelve miles was taken, giving the visitors an opportunity of seeing many of the beautiful summer estates.

In the evening there was a "story telling" session that was especially enjoyed from the fact that the "stories" were unique talks on different processes used in the industry. **"The Story of Polishing and Buffing Compounds,"** was told by **Frank C. Townsend**; **"The Story of the Development of Modern Lacquers,"** was told by **Dr. G. A. Givens,** who made his talk more interesting and impressive by illustrations. **"The History and Story of Japan and Varnishes,"** was told by **Amos G. Bissell,** and **Floyd T. Taylor** told **"The Story of a Modern Plating Room."** **Robert E. Ungent** concluded the programme with an interesting talk on **"Artificial Abrasives."** This was one of the most enjoyable sessions of the convention and the evening was all too short.

SESSIONS ON JULY 4

Independence Day dawned gloomy and foreboding with every evidence that the weather man's prediction of unsettled conditions would be verified, as they were during the patriotic luncheon that featured the noon time, the rain began to fall and continued intermittently in heavy showers until late in the afternoon. In the meanwhile the delegates assembled in the convention hall and took up the programme on scheduled time, the morning being devoted to the reading and discussion of papers, **Walter Fraine** presenting one on **"The Qualities Necessary in the Progressive Foreman,"** and **Charles H. Proctor** speaking on **"Better Nickel Plating."** Both received much consideration from the gathering and were followed by the introduction of brief papers and problems from members, which resulted in an impromptu round table discussion, that was especially interesting.

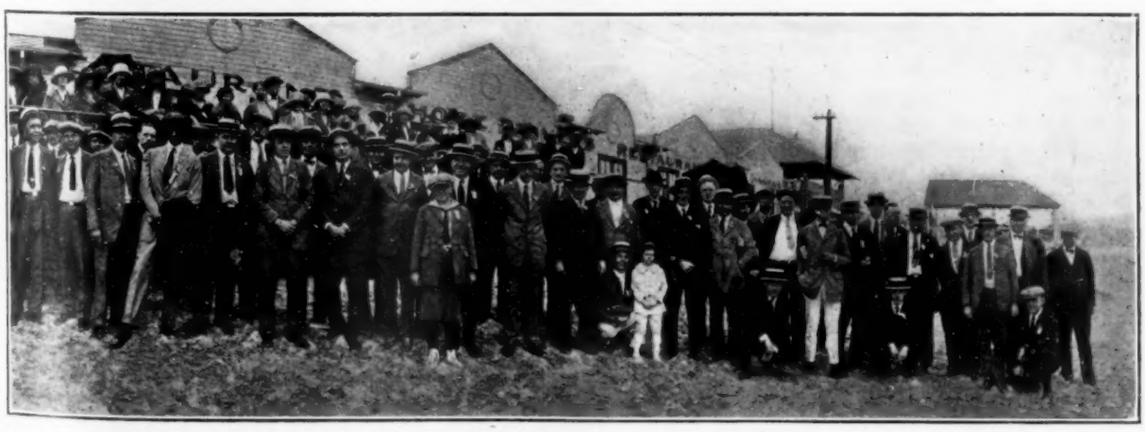
The patriotic luncheon served in the Colonial ballroom at 1 o'clock was all that could be desired to satiate the palate of an picure, but the oration that followed the luncheon was one that stirred the audience to frequent applause and a spontaneous ovation at its conclusion. It was a most fitting tribute to the day and society and will be long remembered by all who heard it. The orator was **Rev. Edward Holyoke, D.D.,** pastor of the Calvary Baptist Church of Providence, who after felicitous introductory remarks, gave his address the keynote of which was **"Social Democracy is True Americanism."**

Honorable President Albert W. Claflin officiated as toastmaster and seated at the head table were: Joseph Service, Philip Uhl, Walter Fraine, John E. Garrick, Charles H. Proctor, Rev. Edward Holyoke, D.D., Dr. Albert W. Claflin, President Walter J. Allen, B. D. Aufderheide, Frank J. Hanlon, Edward Gartland and Gavin J. Tyndall.

At the conclusion of the oration a rising vote of thanks was given Dr. Holyoke, following which the convention returned to the foyer where the afternoon session was taken up and technical addresses were made by **Dr. William Blum** and **H. E. Haring** on **"What is Throwing Power?"** while **E. W. Heil** spoke on **"Nickel Plating"** and **L. W. Graham** on **"The Generation, Distribution and Control of the Eelctric Current in the Plating Room."** A general discussion of various problems introduced by the members followed.

SESSIONS ON JULY 5

The last day of the convention was employed first in visiting manufacturing plants throughout the locality, and in sight-seeing. Among these plants were Gorham Manufacturing Company, Ostby and Barton and Whiting and Davis Company. The tourists also went through Providence, the Attleboros and Plainville. In the afternoon the final business session was held and the officers elected. In the evening a banquet was held and the officers installed. The banquet was, of course, a great success, a sumptuous dinner being followed by entertainment. The dancing which closed the convention was a final party at which everyone had the time of his life before leaving. It was a big convention both from an educational and social viewpoint. Those who attended came away happier and wiser men.



OF THE AMERICAN ELECTRO-PLATERS' SOCIETY, IN NEWPORT, R. I.
does not nearly represent the full attendance.

LADIES' PROGRAM

About 75 ladies attended the convention and although they are not members nor official delegates, they accompanied the husbands to the gathering for the social aspects of the occasion. Special events were planned for their entertainment under the direction of **Mrs. Agnes Garrick of Attleboro,** of the Ladies' Auxiliary to the Providence-Attleboro branch. During Monday most of the visiting ladies remained in the convention hall making or renewing acquaintances, and in a measure, getting the "lay of the land." But in the evening the local ladies gave a theatre party at the Albee Theatre, whole blocks of seats having been reserved for the party.

On Tuesday, Wednesday and Thursday they were busy with clam-bakes, concerts, sight-seeing rides, bridge-whist, fashion shows and, of course, finally, the convention banquet and ball.

NEW OFFICERS ELECTED

The officers for the ensuing year are as follows:

John E. Sterling, New York Branch, Supreme President.

Edward J. Musick, St. Louis Branch, First Vice President.

Elmer W. Woodmansee, Detroit Branch, Second Vice President.

F. J. Hanlon, Chicago Branch, Secretary-Treasurer (re-elected).

F. C. Mesle, Editor Monthly Review (re-elected).

The newly elected officers were installed by George L. Claflin, assisted by George A. Weigand and Harry Sholes.

EXHIBITORS

A list of exhibitors who showed samples of their work and of the products which they market for electroplating, polishing and finishing shops were as follows:

Apothecaries Hall Company, Waterbury, Conn. Nickel anodes.

Bias Buff Company, Jersey City, N. J. Buffs.

Belke Manufacturing Company, Chicago, Ill. Filters.

Baltimore Copper Smelting & Rolling Company, Baltimore, Md. Copper anodes.

Baker & Company, Inc., Newark, N. J. Platinum anodes.

Z. Berberian, Providence, R. I. Supplies

Celluloid Zapon Company, New York City. Lacquers.

Geo. L. Claflin Company, Providence, R. I. Supplies.

Egyptian Lacquer Manufacturing Company, New York City. A new line of fixture finishes in gold and enamel combination. Featured Matte and Florentine gold lacquers.

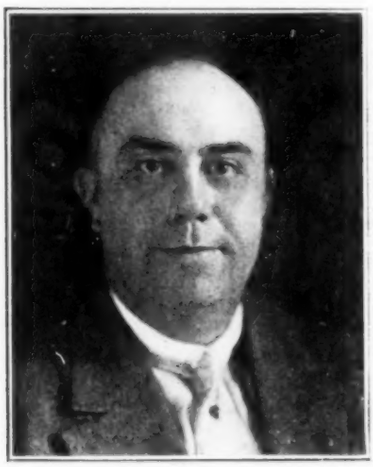
J. B. Ford & Company, Wyandotte, Mich. Cleaners.

Hanson & Van Winkle Company, Newark, N. J. Equipment and supplies.

Henderson Brothers, Waterbury, Conn. Tumbling barrels.

A. P. Munning & Company, Matawan, N. J. Equipment and supplies.

Magnus Chemical Company, Brooklyn, N. Y. Cleaners.



F. J. HANLON,
Secretary-Treasurer

F. C. MESLE,
Editor, the Monthly Review

G. J. TYDALL,
Chairman of the Convention Committee

By a vote of 40 to 24 Milwaukee was chosen as the town in which the next convention will be held. This is in line with the general policy of the society to change conventions East and West from year to year.

By a vote of the Executive Board, the Society was authorized to arrange for a enlarged exhibit of equipment, supplies and finishes on the plan of the Metal Finishers' Exposition, held in Dayton in April.

It was estimated that from 340 to 350 visitors registered at the convention. The members and their ladies had nothing but praise for the managers of the convention and for the hospitality with which Providence received them. Congratulations are decidedly in order for the convention committee, all of whom played a part in making the New England convention such a success.

Seymour Manufacturing Company, Seymour, Conn. Nickel anodes.

E. J. Woodison Company, Boston, Mass. Composition.

Williamsville Buff Company, Danielson, Conn. Buffs.

During the convention and at the banquet attractive and useful souvenirs were distributed by a number of the supply houses.

CORRECTION

In our last issue (June, 1923) on page 227 a picture of the plant of the Whiting & Davis Company, under which the address was given as Plainfield, R. I. This was an error. The correct address is Plainfield, Mass.

Early Days in the Electro-Plating Industry

Reminiscences of a Plater Who Has Been with the Industry Since the Early Days in the United States. Part 2*

Written for The Metal Industry by C. H. BUCHANAN, of The Ely Anode & Supply Company, Hinsdale, Mass.

SOLUTIONS USED

There has not been much improvement made by the platers in using additional agents with their solutions except that Dr. Weston was the first electro-plater to use boric acid with the double sulphate solution (from 3 to 5 oz. to the gallon). But most of the old platers were skeptical about using boric acid and did not want to add other chemicals in addition to what they were using (sulphuric acid and aqua-ammonia). If the solution contained too much free acid the old formula for the double solution was used: 12 oz. of the double nickel salts to 1 gallon of water. My father still worked with the double chloride solution, and I made the nickel salts. In fact, I made considerable and when I had the time fitted up a number of the job shops that wanted to try out the chloride solutions. A good many platers' helpers who had worked in the job shops started plating plants and worked by the rule-of-thumb plan. They were not much like the old platers who were the first to introduce good plating with the equipment they had at that time.

A few years later, when the safety bicycle was all the rage, the nickel-platers were very busy on that class of work, and a number of new plants were established, especially with the manufacturers of bicycles. The nickel supply houses were very busy for some time fitting up new plants. In some of the plating plants they began to use single nickel salts, in connection with the double salts for metal content. In fact I have advised the using of single nickel salts with the double for many years in the past. But some of the platers still wanted to let well enough alone and not add anything to their solutions except sodium chloride or ammonium chloride, as an additional agent.

I know of one very large concern that has been using a single salt solution with boric acid and sodium chloride, 95-97% anodes and agitating their solutions. They have followed this practice for about 18 years. The improvement was made by their electro-chemist who had been experimenting with the single salts. Twenty years ago, in talking with a plater in a large stove concern where I was selling anodes and nickel salts, the plater wanted to know if I had ever used epsom salts for a brightener in my nickel solutions. This concern was doing nickel-plating, as I can vouch that as we have used one of their kitchen ranges with nickel trimmings a number of years. Of course, the plater did not know that the chemical name of the salt was magnesium sulphate, but he had been advised by a plater who had used the salts and obtained good results for bright nickel work. When the German nickel salt, called Prometheus, was first introduced in this country a number of concerns installed the Prometheus solution which contained 27.58% nickel sulphate; 18% ammonium sulphate; 10% boric acid; 2.75% magnesium sulphate; 41.10% water. The solutions were made by adding 2 lbs. to the gallon, but the platers and concerns did not want to pay the high price that was charged for the salts and in a good many cases discontinued using them. They made their solutions with single salts containing more metal. Magnesium sulphate has been added to solutions by a number of platers.

Nickel chloride is being added to nickel sulphate solutions to corrode the anodes if they do not dissolve freely. I have had long experience in making chloride of nickel salts and running the double chloride solutions. I know that the anodes are a great deal more soluble in this solution than in the sulphate. In fact I have advised some of the platers to use a little muriatic acid in their solutions if the anodes were not dissolving properly. It has been a question in my mind for some time whether adding some of the salts to the nickel solutions and stating they are used for conductivity was correct when they are adding magnesium sulphate and other salts for a bright deposit. The double nickel chloride solution deposits much faster than the sulphate, I should say 2 to 1 for speed.

I notice that one writer states that the great majority of platers have associated throwing power with conductivity. My experience has been that when the solutions have not deposited very well on deep work, such as covers or reflectors, by using ammonium chloride, the nickel was deposited much better in the recesses, due to the throwing power which the chemist refers to in his paper on conductivity.

Some of the electro-platers and writers on nickel-plating have stated that a deposit of nickel from the chloride solutions on iron and steel work will oxidize and rust through the deposit much sooner than if plated in nickel sulphate solutions. That may be true, but if a close grained deposit is obtained from the chloride solution, the plating will last some time before the rust breaks through. I think the electro-chemists are right when they state that there is a great difference between the structure of a coarse grained crystal deposit and a fine grained one. The oxidation of the base metal breaking through the nickel takes place much sooner with the coarse grain.

Of course, the price of nickel chloride compared with that of nickel sulphate is prohibitive. But I have done some good plating with it. And the anodes replenished the bath with nickel much more readily than with the nickel sulphate solutions.

The question of conductivity and throwing power has been on mind for some time, especially having had so much experience with the nickel ammonium chloride solutions and using ammonium chloride instead of sodium chloride to throw the deposit to the lower lights as they say of articles to be nickel plated.

I notice in the letter of the research committee's report that there is a distinct relation between the crystalline structure of the base metal and that of the deposited metal.

In my experience with nickel-plating on iron and steel the fine, close-grained deposit did not rust through the steel or iron work as soon as a coarse deposit. The metallurgists and chemists have stated that an electro-deposit of nickel or cobalt has more affinity for steel and iron than a deposit on brass, copper and other metals. I think this statement is true, as I have seen deposits many times on skates and bicycle parts that have been copper plated and the nickel did not adhere to the steel as well as if they had only been nickel-plated. In fact I have advised many concerns that if there was a good close-grained deposit made on their steel work, the work

*Part 1 was published in our issue for June, 1923.

did not require a copper deposit. I am not speaking now of a copper strike solution but of the work that they used to put a heavy coat of copper on. The copper strike solution I used many years ago for a cleaner more than the deposit of copper, on syphon heads for vichy bottles, and I have plated many thousands of them when other nickel-platers did not have much success in plating them.

To come back to oxidation of nickel-plating on iron and steel, I have always thought that the rust breaks through the nickel from the base metal, especially on iron castings. Of course, when you plate highly polished steel, it does not rust as soon as the castings.

When nickel-plating begins to oxidize, if you do not take care and keep cleaning the deposit, you cannot buff it up again and obtain the high color that the deposit had when plated. It is different with silver-plating as the oxide or sulphide which has formed can be buffed up again to a good color. Moisture and damp weather are bad for nickel work, but heat prevents the plating from oxidizing, that is, preserves the deposit much longer than on work that is exposed to more or less moisture, especially when it is exposed to the moisture in the atmosphere. If the deposited metal oxidizes before the base metal then it seems to me it is a better protection, and the oxide will not break through the deposit as soon as through the nickel deposit on iron or steel. A good deposit of zinc we all know is a much better protection than a nickel deposit. But as the Research Committee states, there is a difference in the structure of the deposit, and I think a good fine-grained deposit is, of course, a great protection.

I have examined steel and iron work that has been nickeled, through a microscope and you could notice the structure of the deposit which would look in some cases like a very coarse deposit. If you have ever looked through a powerful microscope, at a piece of steel before it is polished, you would notice that the steel surface would look quite rough. I may be wrong, but I have noticed work that has been nickeled on iron castings, after it had been placed in stock, to have rust spots from coarse castings, and the rust of course had broken through the nickel. I will not dwell on this subject any longer, but I am only stating what I have been through in examining nickel deposits for some of the largest concerns in the country. A good, heavy, fine, close-grained deposit of nickel, as I stated before, is much better for preventing oxidation than a coarse structured deposit, and if you have the work plated with zinc, it still forms a much better protection from rust especially on outside work, or any other steel or iron that has to be nickel-plated.

MECHANICAL IMPROVEMENTS

The first improvement in plating small work in place of using the old brass, copper and iron wire mesh baskets was invented by Smith & Deakins. It was called the Rotary Plating Apparatus and it is stated they took out an English patent in 1896. However, all credit is due in this country to the Hanson and Van Winkle Company for introducing their mechanical plater which was an improvement over the Smith & Deakins rotary plating apparatus. I think it was about the same time or soon after that the U. S. Galvanizing Company patented a mechanical plating barrel.

The next invention for rapid nickel-plating was the Broderick Conveyor, which was used by the largest concerns that had very large quantities of work to plate, such as the Yale & Towne Company, Corbin Cabinet & Lock Company, and Sargent & Company. At the present time, some of the plating supply houses are manufacturing conveyors.

RESEARCH AND EDUCATION

The information that the platers receive from our electro-chemists who are experimenting in a scientific manner to find out what happens when certain salts are added to solutions, and the electro-chemists of the Bureau of Standards, will be a great help to the foreman electro-platers especially those who belong to the American Electro-Platers' Society. In taking up this work the chemists of the Bureau of Standards who are assisting our Research Committee to find out the best formulæ to use for standard nickel solutions, deserve a great deal of commendation, and we must not forget the members of our Research Committee who are working and experimenting for the best results that can be obtained from electro-plating.

My advice to the young men who are foreman plater or their assistants is to attend some technical school or institute in the evenings and take a chemical course. I attended Pratt Institute of Brooklyn some years ago when they first started a chemical class and I never regretted the knowledge I gained in chemistry. It has been a great help to me with my practical work in running plating solutions.

Anodes for Chromium Plating

Q.—Where can I obtain lead dioxide anodes for chromium plating, as outlined in the article on "Chromium plating" by R. E. Search in your issue of March, 1923?

A.—I do not know of any firm now making such anodes in this country, although they are a commercial article in Germany. Nevertheless, there should be no difficulty in having them made to order by any lead-storage battery company which is equipped to make lead dioxide anodes as they are used in all lead-storage batteries.

In a vessel filled with pure diluted H_2SO_4 of specific gravity 1.15 to 1.20 dip two electrodes, one of which consists of porous lead metal and the other of porous lead dioxide.

A secondary element thus constituted is capable of work, while it furnishes the current, the porous lead plate like the porous lead dioxide is converted into lead sulphate; the gray like the dark brown electrode plates are clean, because, by the formation of the sulphate, at the same time, a great quantity of sulphuric acid is consumed. This consumption of the acid can be recognized by the lessening or lowering of the specific gravity of the liquid.

In the charging of the lead storage battery this specific gravity again rises to its original intensity, while at the same time the cathode again changes from the gray modification to metallic lead, and the lead anode is converted into dark brown lead dioxide.

In practice, however, it is advisable to not drive the discharging of the battery so far as to cause the brown lead dioxide to disappear; one always has to remember to see that one of these plates is kept dark brown and the other light gray.

In electrolyzing with dilute sulphuric acid, simply use a lead plate as an anode. The chemical changes will take place as first described.—R. E. Search.

Survey of Nickel Solutions

To Bring Out in an Orderly Fashion, Much of the Data on Nickel Solutions Scattered Throughout Various Sources That Will Be of Value to the Electro Plater and to Refute Some Statements Are the Purposes of This Article—Part 5*

Written for The Metal Industry by JOSEPH HAAS, JR., Plating Superintendent

CONTROL OF PH OF NICKEL SOLUTIONS

The maintenance of a uniform pH or degree of acidity in nickel solutions depends upon securing equal anode and cathode efficiencies; that is, the same amount of metal is to be dissolved from the anode as is deposited at the cathode. If the anode efficiency is less than the cathode efficiency, the solution becomes acid, or the pH decreases (degree of acidity increases). Mechanical losses of solution made up by the addition of water do not cause any marked changes in acidity. Therefore, if the pH of a solution changes during operation, it is due to either a difference between anode and cathode efficiency or through the accidental addition of acid or alkaline by insufficient rinsing of the work to be plated.

Under any given uniform conditions of operation, there is a tendency for an equilibrium pH to be reached, the numerical value of which will depend upon such factors as the composition of the solution, composition of the anodes, temperature of the solution, anodic and cathodic current densities and surfaces. If by any means the acidity should be increased, anode corrosion will increase and cathode efficiency decrease. The mere adjustment of the pH to any desired value will not necessarily insure uniform operation unless other conditions are also properly controlled.

Measurement of pH at regular intervals will indicate whether there is a tendency for the solution to change in acidity, and the direction and extent of the change. The desired changes in pH can be made by the appropriate substances, boric acid or hydrochloric or sulphuric if used carefully, to lower pH or increase degree of acidity; nickel hydroxide or carbonate to increase pH or decrease degree of acidity. The proper amount of any of these reagents are very readily determined through practice.

The best plating solution, other things being equal, would be one that maintains a constant pH or one which has its pH least changed by the addition of either acid or alkali, as then the desired acidity can be most readily maintained. Such a solution is said to be "well buffered," and this type of solution is most readily secured by having present weak acids or their salts, of which boric acid is a good example.

Present indication are that nickel solutions for correct operation should be between the pH limits of 5.4 to 6.0. However, it must not be concluded that the control of pH will eliminate all nickel plating difficulties, if other factors are neglected. Control of pH is but one of the factors in securing more uniform deposits.

A SIMPLE METHOD FOR MAINTAINING NEUTRALITY OF NICKEL PLATING SOLUTIONS

Methyl red as an indicator for the control of nickel plating solutions was put into operation by Oliver W. Storey before the Bureau of Standards commenced its work on pH control. Storey made no actual pH measurements, but used this indicator in the manner that litmus is used. Storey, also called his correct nickel solution reaction neutrality. It is probable that were actual pH measurements made his solution would undoubtedly have been found to be slightly acid. Methyl red, being a more delicate indicator, would show nickel solutions that were neutral and litmus to be really quite acid.

The methyl red solution for this purpose is made as follows: A 0.2% solution of caustic soda is first made. Dissolve in 100 cc. of this solution 2 grams of methyl red. The solution of methyl red in caustic soda is diluted to 2,000 cc. with distilled water and filtered, resulting in a bright red solution. The method of testing nickel solutions must be carefully carried out, using the same amount of solution and indicator each time, the bottle or test tube being marked to a certain capacity. Unless this is done, the tests are useless for comparative results. The methyl red indicator is kept in preferably a bottle with a medicine dropping tube, so that the drops may readily be counted. Take a definite amount of the nickel solution to be tested as 5 cc. in a test tube, add a drop of methyl red indicator and shake well. The resulting color is noted and if necessary compared with samples taken from 3 standard nickel solutions treated in the same manner with methyl red indicator. These nickel standards are of the same approximate composition as the solutions tested, but in addition are acid, neutral and alkaline. The color which results when the methyl red is added to the solution tested determines the condition of the bath. When tests are carried out in the manner indicated, the color of the solution will vary from a light green or yellow green when alkaline and yellow, orange brown, brownish purple and purple as the nickel solution neutral or acid.

IMPURITIES IN NICKEL SALTS

The first requisite in preparing a nickel solution is to use the purest obtainable chemicals. The nickel plating solution is one of the simplest that can be made and to operate successfully from the beginning, but it can easily be regarded as one of the most difficult solutions to control. This is due, first, to its position in the table of electrode potentials, where it is electro-positive to hydrogen, and therefore exhibits a reluctance to deposit, if conditions are favorable to the deposition of hydrogen; and, second, because the color and the character of the deposit are affected by impurities of copper and zinc, and possibly by iron and tin, although of the latter two no definite results have yet been obtainable. A study of the various impurities in nickel salts has lately been made by the Bureau of Standards to determine the effect of the principal impurities found in them upon the character of the deposited nickel. It was found that of the impurities present, copper and zinc are especially objectionable. The effects of iron were found to be contradictory. The results summarized are:

Effect of Zinc. Small amounts of zinc (0.2%) tend to cause bright edges and smooth surfaces. Larger amounts (0.3%) will bring out bright hues, spots, and patches on the surface, tend to increase pitting, the pits being distant from the spots. The effect of small amounts of zinc becomes more noticeable as the time of deposition is continued. The influence is probably felt from the start and the accentuation is due to the gradual increase in the concentration of the zinc ions around the cathode caused by migration. Excessive amounts of zinc (0.44%) will cause gassing at the cathode, attended by a very characteristic loose, black, scaly deposit apparent from the start of the deposition. Small variations of pH do not have much effect upon the action of zinc, but by

*Parts 1, 2, 3 and 4 were published in our issues for September, 1921; November, 1922; February, 1923, and June, 1923.

suitable adjustment of pH it has been found possible to prevent entirely the action of even excessive amounts of zinc. If the solution is neutralized with nickel hydroxide or carbonate to a pH 6.7, allowed to settle, filtered and acidified to pH 5.8 and electrolyzed for several hours at a high current density, no further trouble will be experienced. Evidently the zinc in the solution is almost entirely precipitated out at pH 6.7.

Effects of Copper. Small amounts of copper (0.05%) tend to cause a slight roughness near the bottom of the cathode caused by scattered dark trees or burrs. The effect of small amounts of copper seems to be greater the longer the deposition is continued. Larger amounts (0.1–0.5%) cause this roughness to spread up toward the top of the cathode, and to cause very spongy, dark-grey voluminous deposits at the bottom. There seems to be no especial tendency toward gassing. Variations of pH do not seem to have much effect upon the action of copper, and by neutralizing with nickel carbonate, copper can be completely removed from nickel salts from which a solution is to be made.

PROPOSED SPECIFICATION FOR NICKEL SALTS

	Not over—percentage
Zinc	0.05
Copper	0.02
Iron	0.10
Free Acid	0.10

Nickel in single nickel salts not less than 21.39%
Nickel in double nickel salts not less than 14.72%

EFFECT OF CURRENT DENSITY

Low current densities cause the deposition of large grained and brittle deposits. A slight increase in current density results in smaller crystal structure and softer deposits; while greater increases in current density bring smaller crystal structure and increase in hardness. Still greater current density results in pulverent or burnt deposits. Generally summarized, it can be stated that an increase in current density decreases the size of the crystals and improves the deposit, because what the plater calls a good deposit is one that is fine-grained and hard accompanied with ability to take a high polish and relative freedom from porosity. The object, then, of every plater is to find the critical current density or the highest current strength that he can use without burning, as then he will have a hard, fine-grained deposit that will take a high lustre.

ELECTRO-MOTIVE FORCE

This factor depends primarily upon the resistance of the bath, which is affected by the composition and temperature of the bath, and the distance the electrodes are apart. The temperature and electrode distance are best determined by the character of the work to be plated. Then increasing the voltage to obtain the critical current density will yield the best deposits obtainable with a given solution.

The Spotting Out Problem

Suggestions for Reducing This Difficult Problem to a Minimum

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

Spotting out usually develops from June to September and is a distressing problem to platers especially to those who must deposit copper, bronze or brass from cyanide solutions upon any of the commercial metals whether die castings, zinc, steel or malleable and gray iron. Even cast brass, and in many instances, sheet brass is susceptible to the disease as we might term it. Nickel and silver deposits cause but little trouble due to spotting out unless sulphur combinations are used for oxidizing upon silver. Then the same precautionary measures must be applied as with copper, bronze, brass or oxidized finishes applied to such deposits.

First. The free cyanide content of all cyanide plating solutions should be kept down to the minimum. It is advisable to make minute additions each day, preferably at the close of the day's work, instead of carrying an excess to last several days or a week.

Second. In brass plating eliminate, if possible, the use of ammonia water, and use instead small amounts of caustic potash to keep the brass anodes free from zinc oxide and hold the zinc cyanide in solution. Amounts of ⅛ ounce or less per gallon of solution will be ample at one time. In copper plating avoid an excess of sodium hyposulphite. Small amounts of bisulphite soda or sodium bicarbonate are of advantage in copper solutions, the copper being maintained in the cuprous condition, instead of cupric. Furthermore the use of bisulphite of soda in the summer time enables the plater to maintain a lower free cyanide content in his copper or brass solutions.

Third. Wash thoroughly all plated deposits in cold and boiling water and repeat. The expansion and contraction of the metal under the influence of heat and cold will help to force the plating solution which is diluted by the rinsing water, from the pores and pin holes.

Fourth. The use of about two zinc anodes in the hot water tank with an addition of 1/16 to ⅛ ozs. of phosphoric or acetic acid maintains a slight acidity which reacting upon the zinc liberates hydrogen which later helps in preventing the formation of oxides.

Fifth. After plated or oxidized articles have been washed thoroughly as outlined, then dry out at 212° F. if possible. The heat evaporates the moisture and thus prevents water spotting under the lacquer.

Sixth. It should be remembered that if only heat is used in trying to eliminate spotting out, only the water is evaporated; the solids remaining behind unless eliminated by thorough washing. The solid, i. e., the materials contained in the plating solution, when not washed out of the pores and pin holes of the base metal, absorb moisture in a humid atmosphere, the pores filling and overflowing, giving a greater spot than the actual dimension of pin-holes or pores.

Seventh. Many firms are now using as a basis the so-called water dip lacquer followed when hard and dry by the regular spray or brush lacquer. The articles are placed in the water dip lacquer at a temperature of not less than 120° F. The contraction of the metal draws the lacquer into the pin holes and pores and practically plugs them up. The solids that remain in the pores such as cyanides and metal salts, especially when they absorb moisture and possibly form ammonia have a reducing action upon the cellulose lacquers. Whenever black spots occur due to spotting out it is found that the lacquer invariably has been reduced. As a proof of the dissolving action of such a combination, experiments will show that gun cotton, or nitro-cellulose is soluble in a solution of carbonate of copper, ammonia hydrate and water.

The paint slogan "Save the Surface and You Save All" is applicable to plated surfaces during the humid weather of the summer.

Tarnish Resisting Silver

Written for the Metal Industry by Our British Correspondents

Considerable interest has been aroused in British metallurgical circles by the announcement at Sheffield of the discovery of a silver alloy of sterling quality which is said to resist atmospheric tarnishing. An account was given of the discovery at a symposium held in Sheffield on April 13th under the auspices of the Faraday Society, the Institute of Metals and other societies. Harold Turner, of William Turner & Company, Eyre street, Sheffield, stated that he had been working in this matter with gold and silver refiners of W. G. M. Boyd, the works chemist of the firm, and had also had some assistance recently from Ernest Smith, who for some time was director of the British Non-Ferrous Research Association.

Mr. Turner said that he and those associated with him had for the past two years been studying sterling silver with a view to obtaining an alloy which would resist atmospheric corrosion. They had produced a material which was not in any sense acid-resistant, but only resistant to the ordinary atmosphere. Sterling silver which would carry the British Hall Mark must contain 92½ per cent silver, so that they had only 7½ per cent with which to do as they liked. Bearing this in mind, he thought it was a little too early yet to talk about stainless silver. Very considerable progress had been made, and the metal had been issued commercially to the trade within the last few days.

He had in his possession some of this silver which had been exposed under ordinary atmospheric conditions in his own home and elsewhere, and which had gone for two years without cleaning with any polishing medium whatever. It was, of course, necessary that the silver should be kept free from dirt and dust. They were now able with a fair amount of confidence to issue to the trade an alloy which was fit to take its place with other silver, when they considered all the questions involved such as color and working properties. The studies of the alloy were to be continued, and he hoped at some future date to be able to give further information about it.

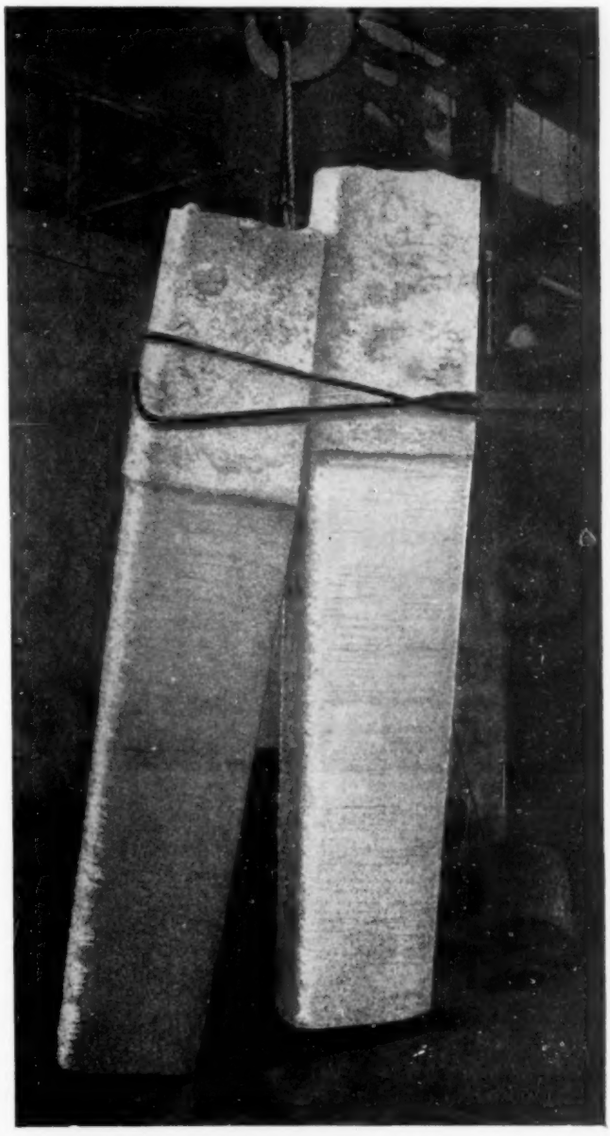
Interviewed subsequently with regard to the alloy, Mr. Turner said, "We disclaim absolutely the use of the word 'stainless' in this direction, but we have succeeded in producing an alloy which represents a valuable advance; it is tarnish-resisting to a remarkable degree and has an excellent color. If worked properly it retains its color and brilliance over long periods. When exposed to the atmosphere under ordinary conditions articles made of the new material, instead of requiring cleaning weekly, will for months retain a factory polish.

The new silver, however, has already been known to the trade for some time. It has been under trial among the Birmingham silversmiths, whose opinions with regard to its utility differ. A member of one of the leading Birmingham firms says that although the alloy does not tarnish like ordinary silver it does not present the same high finish when made up. As it was also more expensive he was inclined to think that these disadvantages outweighed the advantages. Ordinary silverware, he pointed out, could be prevented from tarnishing by a coat of lacquer.

A member of another firm which has experimented with the new silver during the last eighteen months declares that it has stood the tests to which it has been subjected very well. It has been found more difficult to work up than the ordinary standard silver, but these difficulties would be easily overcome as the workmen became experienced in its use. One peculiarity noted by this informant was that the new silver had to be finished with special bobs. If the bobs used were those employed on standard silver, the new metal would tarnish. Special wash leathers must also be kept for wiping it. He thought the new silver could be usefully employed in the manufacture of such articles as cups and rose bowls. His firm was already making a cup of it, and if they found it successful they intended to experiment with its use for mirror frames and other decorative articles. He thought the slight difference in cost would be counterbalanced by the fact that its use meant the saving of work in the home, while one might also take into account the comparatively slight loss of weight in polishing.

Large Nickel Ingots

The illustration shows two two-ton nickel ingots after being stripped from the ingot molds at the Huntington, W. Va., works of the International Nickel Company.



TWO-TON MALLEABLE NICKEL INGOTS

Metal Spinning

Some Pointers on This Art by an Old-Time Expert

Written for The Metal Industry by R. MAGOSY, of Magosy & Buscher, New York

Metal spinning was introduced in the United States about 1840 by a German named Jordan. He had a small shop in New York and several apprentices, but after they became spinners some of them started in business for themselves. Some failed, but some existed for a long time, until they became old and gave up.

Mogosy & Buscher, of 232 Canal street, New York, the firm of which the writer is a member, are made up of the old-time expert spinners on any kind of metal. The writer himself started as an apprentice at 14 years of age and has been at it for the past 34 years. Carl Buscher started at the age of 15 and has been at it for the past 55 years, spinning steadily. He has devoted a lot of time to sterling silver spinning. He sold his share of business to his nephew about two years ago, a young man of 35 years of age, who is also a good spinner.

Oval spinning was introduced in this country about 1865 by the P. Pryibil Machine Company. Mr. Pryibil then made a specialty of making good spinning lathes, and it is today one of the best in design and for easy running. He made the first oval chuck in 1865 and it is still one of the best chucks for spinning.

SPUN ALUMINUM CAN

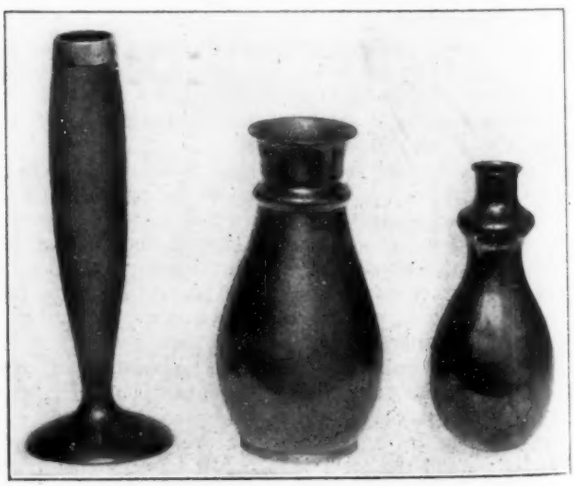
Each metal calls for different treatment in spinning. Take zinc, for example. Zinc has peculiar properties all its own. To do a nice job on zinc, it must be spun hot or no results will be obtained. The zinc will stretch one way only and then it will break. Zinc can't be spun any higher than about 10 inches and even then only to a certain shape. Brass can be spun to a depth of about 20 inches, if you know how, but it requires brains and skill to spin it to 20 inches deep in one piece.

Copper can be spun much deeper than brass and it is easier to spin. Moreover, it can be spun higher in same time than brass. It does not require so much annealing and hammering, but must be watched more than brass because it is softer and it stretches much more quickly. Very often lines appear on the inside, which are called in shops "railroad tracks," and while it is being finished on a split chuck it breaks. Then the spinner tells the boss the copper is no good. Eight chances out of ten it is the spinner's fault.

SPUN SILVER VASES OF ONE PIECE WITH BOTTOM INSERTED

There are few spinners nowadays who know how to handle metal properly and to have nearly the same thickness through the wall of the shell. The majority of the spinning is as thin as paper in the center because it is stretched; the life is taken out of it. The proper way to spin is to have several breaking down chucks before coming to a finishing chuck.

Aluminum spins easily without annealing; it can be spun 25 to 30 inches deep, without annealing, and from 12 to 15 inches in diameter. The only trouble with aluminum is that it sweats black and greasy. Lead also can be spun to a 40 inch depth, like soda water cans.



SPUN VASES OF ONE PIECE WITH BOTTOM

The most artistic spinning is in gold and sterling silver. Sterling silver is very delicate. When spinning it into

deep cups or vases the spinner has to be very careful not to get the silver dirty or scratched and not to stretch it, because if he does he will never finish the vase. A spinner can lose 6 to 7 hours on one cup if he does not watch his step.

These vases can also be made by hand from a circular piece. They can be hammered up by a first-class silversmith and can be made into such a good job that no one would be able to tell whether it is spun or hammered up. However, it takes a longer time to hammer than to spin.

German silver (nickel silver) is also nice metal to spin, but it is rather hard work because the metal is so tough and hard. It requires more annealing than brass or copper. Most of the spinning in nickel silver is for tea and coffee sets for hotels. Ten per cent nickel silver spins more easily than fifteen or twenty per cent nickel. The more nickel in it the harder it is to spin. All nickel silver spun articles sound like a bell when finished and hit with a pencil or piece of wood.

Monel metal requires same treatment as pure nickel, but care must be exercised when spinning either of these metals. They can both be spun into about the same shape, but it is rather a difficult job. Monel metal can be spun up higher than pure nickel, but it requires a little different annealing treatment. Monel metal can be spun into milk shakers, coffee urn covers and other articles. It is very good metal for chemists' ware, such as beakers, scale pans and other things which the chemical laboratories use.

Estafado Finish

Estafado Polychrome finish is somewhat distinctive from the usual polychrome finish. The original method of producing is was first to brass plate the base metal articles, if other than brass was use; then bright acid dip to bring up a semi-lustre. If iron or steel was to be used as the base metal without the preliminary brass plate and bright acid dip, then the high relief parts were polished to a bright surface and cleansed as usual, quite frequently by wet scratch brushing.

The brass parts are usually lacquered with a gold lacquer containing considerable gum, which gives the gold tone as well as acting as a size medium for other colors. The iron parts are preferably coated with one coat of yellow enamel as a primer. The next operation, when the first is dry, is to apply a stipple coat of white lead ground in linseed oil and spar varnish. The lead coat should be painted on and then stippled with a stippling brush and should then be allowed to dry for twenty-four hours.

The next operation is to spray the lead surface with yellow enamel, very wet. The reason for the wet coating is that the enamel so applied in drying will draw upon the stipple coat so it will have the appearance of old cracked varnish that is frequently seen upon furniture, etc. When the latter surface is thoroughly dry and hard, the polychrome colors are applied, reds, blues, greens or any variety of color that will harmonize with the object being treated. The air brush spray is usually used for applying the polychrome colors and blended tones.

The entire surface should be finally gone over with a smut consisting of burnt umber and raw sienna ground in Japan medium and when partly dry wiped off in spots or with a shaded effect with cloths moistened in linseed oil and a little turpentine. The wiping out completes the operation when the articles should be re-dried. This finish is also produced in gold and silver relief. The only difference in the methods as outlined is that either the gold lacquered high lights appear in relief or a flash gold deposit is applied. For silver a thin deposit of silver is applied. Even a nickel or tin deposit may be used as a basic surface. These metals when shown in relief with the proper colors that harmonize with the white deposits is very effective.

When such white metals are applied they should always be lacquered with a lacquer containing considerable gum. The lacquer acts as a size and the oil colors will have more adhesive properties than when applied direct to the metal without lacquering. There is one firm that has adopted aluminum for its lighting fixtures castings as a basis for the stofado finish. The aluminum surface gives a pleasing tone when the polychrome finish is applied and the aluminum is shown in relief. For the gold effect, the aluminum surface should be lightly coated with a copper deposit and then gold lacquered with a deep gold color which in the final finishing is shown in relief. It is easy to deposit copper upon aluminum, if after the usual methods of cleansing aluminum, following the polishing operations, the aluminum is immersed in concentrated nitric acid, washed thoroughly and then immediately plated in a hot zinc cyanide solution of usual composition.

From the zinc solution, wash the article thoroughly and then copper or brass plate them in any good copper or brass solution.—C. H. Proctor.

Obtaining a Fine Surface

Flexible grinding is grinding accomplished on a flexible wheel, and the reason it can be accomplished is in the ability to understand and handle glue processes correctly in order that the glue may exert its maximum power in holding the abrasive on the wheels.

In flexible grinding work requiring more than one operation, it is essential that the direction of the strokes be varied. A deep scratch made with a number 36 emery will be followed by number 60 emery and then on to 120 or any other numbers, and the inclination of each succeeding finer wheel will be to follow the contour created by the first wheel. But, if the strokes are crossed and the angle of the wheel is changed in each succeeding process, it is easier to cut out these deep scratches, and the effect will be time saved and a much better surface secured.

This is particularly true on hand saws and other articles having large flat surfaces where the light refraction has an opportunity to show up the scratches way down underneath. It is perfectly possible for experienced persons to examine a piece of polished work through a magnifying glass and see, even after the work is finished, the scratches that come from the preliminary operations.

The ideal condition to which the metal must be reduced to bring up the highest possible lustre after plating is what might be called a "matted" or sort of a "damaskeened" surface which is, in theory, obtained by moving the work about on the wheel and not having the polishing stroke in any one direction more than an instant at a time. This is exemplified in the action employed in the Hemming glazers, where the knife blade is moved endwise twenty to forty strokes a minute, while it is at the same time being carried down across the wheel. The result is the production of a practically perfect optical surface after the plating is deposited on the knife blade and properly buffed. It gives a depth and brilliancy of lustre to the plating that is not obtained under ordinary hand grinding or polishing processes.—B. H. Divine.

Extruded Brass

The Extrusion Defect in Brass Rods Extruded from a Multiple Die*

By R. GENDERS

For the extrusion of rod of less than about 1 in. in diameter, it is believed to be common practice to employ a die having two or more apertures, the reason for this being related chiefly to the necessary speed of the press and the maximum speed at which the issuing rod can be handled.

In the paper on "The Extrusion Defect," presented before this Institute in September, 1921,[1] no reference was made to the extrusion of multiple extruded rods. It was understood by the author that in such rods the extrusion defect did not occur, but no direct evidence was available, and the paper was thus restricted to dealing with single centrally extruded rod only.

A number of samples, however, have been obtained, the examination of which has provided some evidence of considerable interest. The rods were of 60: 40 brass, 0.625 in. in diameter, and had been extruded from a billet 5.25 in. in diameter through a die having three apertures equidistant from the centre and about 2 in. apart. On machining, portions of the rods were found to be defective. The specimens described were representative of the defective portions. Transverse sections showed in the majority of the specimens a more or less complete U-shaped defect, extending from about the centre to the outer surface of the rod, the two branches meeting the surface at a wide angle. The extremities of the defect could be traced along the surface of the rod as two longitudinal lines or "rokes." Microscopic examination showed the defect to consist of foreign matter and oxide, enclosed in many places by a region free from β constituent (*i. e.*, poorer in zinc content than the general mass of the material), and to be similar in all respects to the tubular defect which may occur in centrally extruded rod of large diameter, and which consists of the outer skin of the original cast billet. Representative fields are shown in the photomicrographs, Figs. 1, 2 and 3 (Plate I.). Fig. 4 is a photograph of the whole of the sample sections. The defect is seen to vary in extent in different specimens. It is not possible to indicate with certainty the original rod from which each section was cut. All three rods are, however, represented.

The peculiar distribution of the defect lends confirmation to the previously expressed conclusions as to the formation of the defect by the turning inwards of the billet skin to follow a funnel-shaped course to the die. Comparing the conditions present when extruding through a die having one central aperture, and through one having three small apertures near the centre, it would seem improbable

*Reprinted from a paper presented at the meeting of the British Institute Metals at Storey's Gate, Westminster, London, England, March 7-8, 1923.

[1]Journal of the Institute of Metals, No. 2, 1921, vol. xxvi. pp. 237-245.

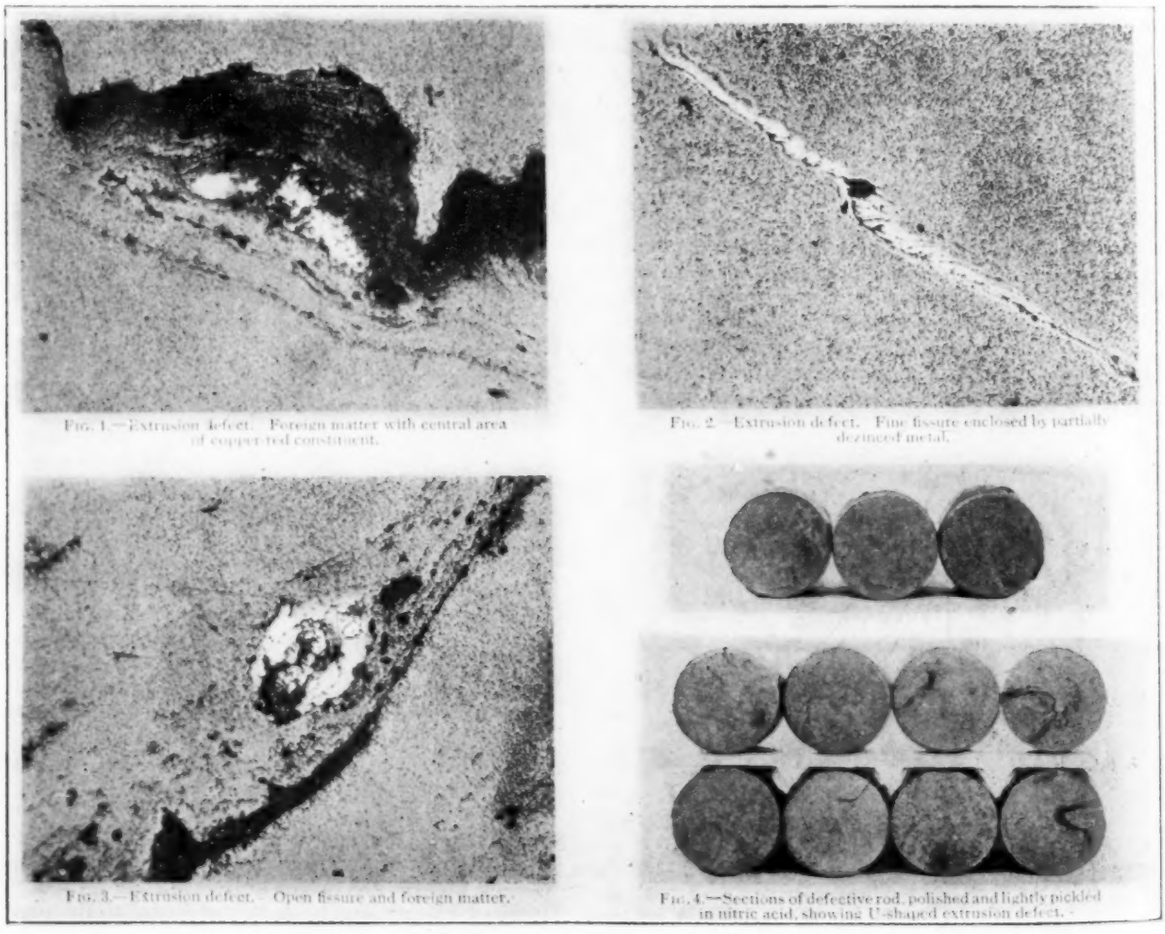


Fig. 1.—Extrusion defect. Foreign matter with central area of copper-rod constituent.

Fig. 2.—Extrusion defect. Fine fissure enclosed by partially decinced metal.

Fig. 3.—Extrusion defect. Open fissure and foreign matter.

Fig. 4.—Sections of defective rod, polished and lightly pickled in nitric acid, showing U-shaped extrusion defect.

PHOTOMICROGRAPHS OF TRANSVERSE SECTIONS

that the frictional effect (and therefore the velocity gradient), or the temperature gradient, could be notably different in the two cases. The tubular defect in the billet, however, could not be tubular in each of the three rods, but would be divided in the manner shown in the diagrammatic view of the progress of the defect formation represented in Fig. 5. The concentric circles represent sections at successive distances from the rear of the funnel formation. At the rear of the die, between the three apertures, would be a region of "dead" metal free from imperfections, such as may exist on the boundary of the funnel formation. The defect formation would be assumed to part on the ridge of the "dead" metal, the edge cut by the ridge issuing from the die on the surface of the rod. Local variations, such as would be produced by variable temperature or eccentricity of the ram, would lead to an unequal distribution of the defect, such as is found in the specimens examined.

There has been no opportunity of reproducing the divided form of defect experimentally on the small scale in brass, but there are no grounds for doubting that the method of extrusion through a die held on the end of a hollow ram, previously advocated by the author, or the other less certain methods outlined, would be as effective in this case as in the former.

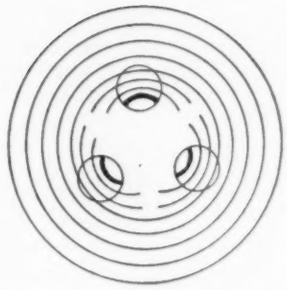


FIG. 5. PROGRESS OF THE DEFECT FORMATION

It will be clear from the author's previous paper on the subject that the "extrusion defect" is confined to a portion only of the rod extruded, whether single or multiple dies are used. Provided that manufacturers take steps to discard, in one form or another, the defective material, there is no reason to doubt that the bulk of extruded rod sold is sound and useful material.

Light Metal Tests

The Mechanical Properties of Magnesium Alloys*

By LESLIE AITCHISON

The desire of constructors of internal combustion engines to obtain the lightest possible reciprocating parts has caused a considerable amount of interest to be taken in the alloys of magnesium for the manufacture of such parts. The lightness of the alloys also makes them very attractive to constructors of the different kinds of aircraft. In view of the interest that has been aroused in these alloys, some investigation has been made of the mechanical properties of the various kinds of alloy.

Tests have been made upon electron metal supplied by the Sterling Metal Company, and also upon various other alloys of magnesium which have been manufactured by the Magnesium Company, Ltd. The materials have been tested in a variety of conditions. Some of the specimens were in the cast condition, some of them had been rolled into strip, others again had been extruded, whilst others were hot forged.

The alloys contained only one element in addition to magnesium. The alloying elements were copper, aluminum in different proportions, and cadmium. This does not refer to the electron metal, which was not analyzed.[1]

The cast test-bars were cast in chill molds and machined to size. The molds, however, were heated to a fairly high temperature prior to casting, with the result that the chilling effect on the alloys was not very intense.

The proof stress has been determined in accordance with the British Engineering Standards Association's requirements for light alloys.

ELECTRON METAL.

This metal was tested in the form of an extruded round bar of 1¼ in. diameter, and an extruded rectangular bar 1⅛ in. x 11/16 in. The mechanical properties of these specimens were as follows:

	Round Bar.	Rectangular Bar.
Elastic limit, tons per square inch.....	4.4	6.4
Proof stress " "	14.6	11.3
Maximum stress " "	17.6	16.1
Elongation per cent. (on $l = 4\sqrt{\text{Area}}$).	11.0	12.5
Reduction of area per cent.....	13.4	16.3

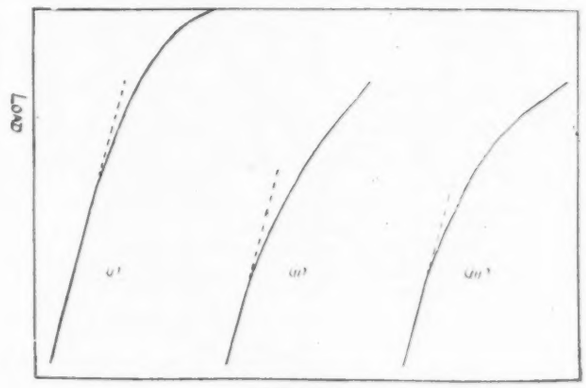


FIG. 1. LOAD/EXTENSION CURVES OF: (i) 6 PER CENT. ALUMINUM ALLOY ROLLED STRIP. (ii) 11 PER CENT. ALUMINIUM ALLOY CAST. (iii) 13 PER CENT COPPER ALLOY CAST

1 PER CENT. CADMIUM ALLOY.

This alloy was tested in the following conditions—(1) "as cast" in hot chills; (2) in the form of a forged square bar; (3) in the form of a rolled strip (0.041 in. thick); and (4) in the form of an extruded rod about 0.125 in. diameter. The forged bar was tested in the forged condition without any heat-treatment. The rolled strip was heated to 300° C. for a brief time before testing. The tensile tests on these various specimens gave the following results:

Condition	Elastic Limit. Tons per Sq. In.	Proof Stress. Tons per Sq. In.	Maximum Stress. Tons per Sq. In.	Elongation per Cent.	Reduction of Area per Cent.
Cast bar	1.2	2.86	4.4	3.5 ($4\sqrt{A.}$)	3.1
Forged bar	...	11.3	14.1	5.0 ($4\sqrt{A.}$)	6.9
Rolled strip.....	5.8	11.2	11.6	1.0 (2 in.)	...
Rolled strip.....	5.8	11.2	11.4	0.75 (2 in.)	...
Extruded rod....	...	...	11.5	...	...
Extruded rod....	...	...	9.7	...	...

*Reprinted from a paper presented at a Meeting of the Institute of Metals held on March 7 and 8, 1923, at Storey's Gate, Westminster, London, England.

[1]See Beckinsale, Journal of the Institute of Metals, 1921, vol. xxvi. p. 375, for information regarding the chemical composition of Electron.

6 PER CENT. ALUMINUM ALLOY.

This alloy was tested in three conditions—(1) "as cast" in hot chills; (2) as rolled strip (0.102 in. thick), after heating to 300° C. for a brief time; and (3) as a thin extruded rod. The results of the tests in these various states were as follows:

Condition	Elastic Limit. Tons per Sq. In.	Proof Stress. Tons per Sq. In.	Maximum Stress. Tons per Sq. In.	Elongation per Cent.	Reduction of Area per Cent.
Cast bar	1.78	5.44	9.1	5.0 ($4\sqrt{A.}$)	4.55
Cast bar	1.8	5.3	9.8	4.5 ($4\sqrt{A.}$)	4.6
Rolled strip.....	5.6	16.6	18.5	7.5 (2 in.)	...
Rolled strip.....	8.2	17.1	18.3	8.0 (2 in.)	...
Extruded rod....	...	...	18.7	...	...
Extruded rod....	...	...	19.6	...	...

13 PER CENT. COPPER ALLOY.

This alloy was tested in the cast condition (in hot chills), and gave the following test results:

Elastic limit,	tons per square inch.....	2.0
Proof stress	" " " "	7.4
Maximum stress	" " " "	7.6
Elongation per cent.	($4\sqrt{\text{Area}}$).....	0.75
Reduction of area per cent	.....	0.36

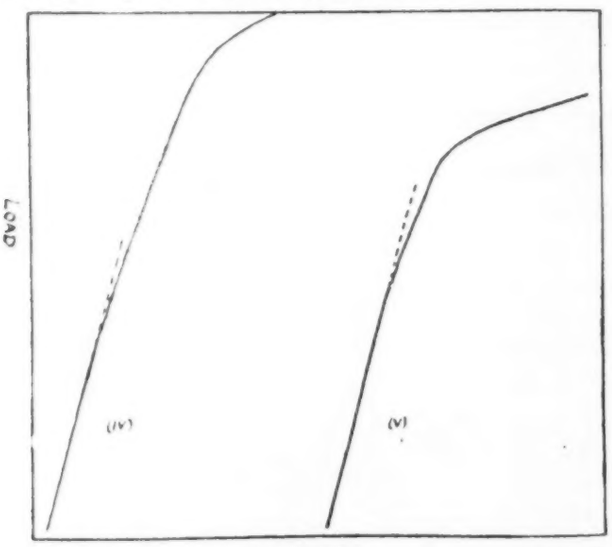


FIG. 2. LOAD/EXTENSION CURVES OF: (iv) ELECTRON METAL EXTRUDED ROUND BAR. (v) ELECTRON METAL EXTRUDED RECTANGULAR BAR

11 PER CENT. ALUMINUM ALLOY.

This material also was tested only in the cast condition (in heated chills), and gave the following results:

Elastic limit,	tons per square inch....	2.0	2.0
Proof stress	" " " "	8.6	8.3
Maximum stress	" " " "	9.3	8.55
Elongation per cent.	($4\sqrt{\text{Area}}$).....	1.0	1.0
Reduction of area per cent	.....	0.36	0.32

3 PER CENT. COPPER ALLOY.

This material was tested only in the form of rolled strip, which was heated to 300° C. for a brief period before testing, and gave the following results:

		(1.)	(2.)
Proof stress,	tons per square inch....	10.3	...
Maximum stress	" " " "	10.9	12.0
Elongation per cent.	(2 in.).....	1.0	1.0

The modulus of elasticity is approximately the same in all the alloys tested, at a value of 2,800 tons per sq. in.

A selected number of load/extension diagrams are given in Figs. 1 and 2 to illustrate the form of curve given by the various materials.

The main conclusion to be drawn from the various tests is the great superiority as regards mechanical properties possessed by the alloys that have been worked—whether hot-worked by forging or extruding, or also cold-worked by strip rolling.

The mechanical properties of the alloys have no definite theoretical interest. The test results do, however, indicate what can be expected from these alloys by anybody who wishes to incorporate them in any engineering structure. In general, it is the aircraft engineer who might be expected to be interested in such light materials. It is a little doubtful whether for his purpose the alloys really are effectively light, in view of their low elasticity and not conspicuously good mechanical properties. The slightly heavier alloys of aluminum are much better in both respects. Better properties in the magnesium alloys may follow from their further development.

Tests All-Metal Plane

The Army Air Service is testing at McCook Field, near Dayton, Ohio, an all metal airplane designated as the CO-1, the first of the kind designed by the army and the latest type of airplane brought out by its engineering division. It has already made a maiden flight and full performance trials are under way.

The plane may be left in the open indefinitely, making the use of hangars unnecessary. It has the further advantage that while the usual fabric wing and fuselage has to be removed once a year, in the case of the all-metal plane the duralumin covering is a permanent part of its structure and does not require replacement.

Both wings of the new planes are covered with corrugated duralumin and the structure proper is heat-treated steel and duralumin. The plane weighs 3,000 pounds empty and 4,750 pounds when fully loaded. Unlike most metal covered planes, the CO-1 is not overweight and air experts said today it can carry loads greatly in excess of the specified design load of 1,750 pounds.

It is powered by the Standard Liberty twelve engine and has a gasoline capacity of 125 gallons. Glass windshields are provided at the sides of the pilot's cockpit, making the use of goggles unnecessary.

Copper Welding Flux

Q.—Will you kindly inform us the best flux to use for welding copper? We have tried the brass flux put up by one of the manufacturers and also borax. With neither have we been able to flow copper.

A.—A flux composed of 1 part sal ammoniac and 12 parts of borax is the best flux for welding copper. To weld copper, use the same kind of flame as for steel but a much larger tip for corresponding dimensions because of the great radiating property of copper. Pre-heating is necessary.

Copper will weld at about 1930° F., hence the flame must not have as high a temperature as for steel and it must not be concentrated on as small a surface on account of radiation. However, the total quantity of heat must be greater. The radiation of heat from copper can be considerably lessened by covering with asbestos sheets while heating.—P. W. Blair.

A List of Alloys

Reprinted from the Booklet Published by the American Society for Testing Materials. Part 4*

By WILLIAM CAMPBELL†

BRASSES (Continued)

PER CENT	COPPER CU	ZINC ZN	TIN SN	LEAD PB	IRON FE	OTHER ELEMENTS
Sterro Metal	55.	42.4	0.83	....	1.8	
Sterro Metal	55.5	42.	....	....	2.5	
Sterro Metal	55.3	41.8	....	....	4.66	
Sterling	66.2	33.1	....	....	0.7	
Sterling, Cast	66.2	33.11	....	0.02	0.66	
Talmi Gold	90.	8.92	....	....	....	Au, 0.91
Talmi Gold	86.4	12.2	1.1	....	0.3	
Thurston's	55.	44.5	0.5	....	....	
Tissier's	97.	2.0	0.5	....	....	
Tissier's	97.	2.0	....	....	....	As, 1.0
Tobin Bronze	60.	38.	2.	....	....	
Tobin Bronze	59.	39.	2.	....	....	
Tombac:						
Oker	85.3	14.7	....	....	....	
Arcet	82.3	17.7	....	....	....	
Ludenscheidt	82.3	17.5	....	....	....	
Red Vienna	97.8	2.2	....	....	....	
Sheet, Paris	92.	8.	....	....	....	
Sheet, Paris	88.	12.	....	....	....	
Sheet, Paris	84.	16.	....	....	....	
Golden	82.	17.5	0.5	....	....	
French	80.	17.	3.	....	....	
French	80.	20.	....	....	....	
Cast	87.	13.	....	....	....	
Common	71.5	28.5	....	....	....	
Tournay's	82.54	17.46	....	....	....	
Tubes, etc.:						
German	70.	30.	....	....	....	
German	60.	40.	....	....	....	
Russian	66.	34.	....	....	....	
Russian	59.72	38.62	0.16	0.34	1.1	
English	65.	35.	....	....	....	
Admirality	70.	29.	1.0	....	....	
Turbiston's	55.	41.	....	....	0.84	Ni, 2; Al, 1.0; Mn, 0.16
Tungsten Brass (Ni, 0.75)	59.73	33.97	0.15	....	....	Al, 2.8; W, 2.; Mn, 0.7
Turbine Brass	75.77	24.07	....	....	....	
Turbine Brass	67.35	32.02	....	0.23	0.38	
Vanadium Bronze Vn-c	61.	38.5	....	....	....	V, 0.5
Vanadium Brass	70.	29.5	....	....	....	V, 0.5
Washer Brass	62.00	38.00	....	....	....	
Wheel Brass	68.00	30.00	....	2.00	....	
Wire	70.29	29.26	0.17	0.28	....	
Wire, English	70.29	29.36	0.28	0.17	....	
Wire, Augsburg	71.89	27.33	....	0.85	....	
Wire, Common	65.4	34.6	....	....	....	
BRONZES						
Acid Bronze	88.00	10.00	....	2.00	....	
Acid Bronze	82.00	8.00	2.00	8.00	....	
Acid Bronze	84.00	9.50	....	6.30	0.20	
Ajax Plastic	64.00	5.00	....	30.00	....	Ni, 1.
Ajax Phosphor	79.30	10.00	....	10.00	0.7	
Allan Red Metal	50.00	....	....	50.00	....	S, 0.25
Allan Red Bronze	62.50	7.50	....	30.00	....	
Amax Metal	81.30	11.00	....	7.40	0.3	
Argental	85.00	10.00	....	....	....	Co, 5.0
Argozoil	54.	2.	28.00	2.	....	Ni, 14.0
Arsenic	79.7	10.00	....	9.50	....	As, 0.8
Bearing Bronze (Kaiser):						
Locomotive	74.	10.	9.	7.	....	
Prussian	84.	15.	1.	....	....	

*This booklet can be obtained from THE METAL INDUSTRY for $1. Parts 1, 2 and 3 appeared in our issues of March, April and May, 1928.

†Professor of Metallurgy, School of Mines, Columbia University, New York.

	COPPER CU	ZINC ZN	TIN SN	LEAD PB	IRON FE	OTHER ELEMENTS
Belgian	80.	16.	....	2.0	....	Sb, 2.
French (Northern)	82.	10.	8.	....	....	
Russian	77.	10.2	5.1	7.7	....	
Railroad Cars	82.	18.	....	....	....	
Railroad Cars	84.	16.	....	....	....	
Railroad Cars	75.	20.	5.	....	....	
Rheinland	86.	12.	2.	....	....	
E. B. D., Breslau	88.	10.	2.	....	....	5 per cent of P Sn
E. B. D., Berlin	90.	10.	....	....	....	
Automobile	88.	8.	....	3.	....	1 per cent of P Sn
Automobile	78.	8.	1.	12.	....	1 per cent of P Sn
Automobile	80.	10.	....	8.	....	2 per cent of P Sn
Various	83.	14.	2.	1.	....	
	83.7	14.2	2.1	....	....	
	85.5	12.8	1.7	....	....	
	83.	12.	5.	....	....	
	85.	11.	4.	....	....	
	74.5	9.5	8.9	7.1	....	
	77.	9.	14.	....	....	
	83.7	8.8	7.5	....	....	
	84.	8.	....	8.	....	
	81.	7.	3.	9.	....	
	78.	7.	....	15.	....	
	70.	6.5	2.	1.5	....	
	86.	6.	5.	....	....	Mn, 2.7
	72.4	4.7	29.9	1.5	....	
	75.	4.	21.	....	....	
Bearings of Engines	79.	8.	5.0	8.0	....	
Bearings and Valves	80.	16.	....	2.	....	Sb, 0.2
Bell Metal	75–80	25–20	....	....	....	
"Best"	78.	22.	....	....	....	
Reichenhall, 600 years	76.2	23.8	....	....	....	
Reichenhall, 300 years	80.	20.	....	....	....	
Old Bell at Rouen	71.	26.	1.8	1.2	....	
Damstadt	73.94	21.67	....	2.11	....	Fe, 0.19; Ni, 2.
Damstadt	72.52	21.06	....	2.14	....	Fe, 0.05; Ni, 2.66
Musical	84.	16.	....	....	....	
House	80.	20.	....	....	....	
Clock	75.	25.	....	....	....	
Herbohn	60.	35.	5.0	....	....	
Herbohn	71.43	26.4	2.7	....	....	
Karakane	71.42	14.2	....	14.3	....	
Karakane	70.	19.	3.	8.	....	
Karakane	65.95	17.25	3.45	10.35	....	
Karakane	64.	24.	9.	....	....	Fe, 3.0
Karakane	62.5	25.	9.4	....	....	Fe, 3.1
Karakane	61	18.	6.	12.	....	Fe, 3.0
Bilgen-Bronze	97.32	1.89	....	0.24	....	Fe, 0.52
Bridge Bronze A	80.	20.	....	....	0.1	
Bridge Bronze B	85.	15.	....	....	0–1	
Bridge Bronze C	80.	10.	....	10.	0.7–1	
Bridge Bronze D	88.	10.	2.	....	0.25	
Bismuth Bronze	53.	15.	20.	....	....	Ni, 10.; Al, 1.; Bi, 1.
Brasses	74.4	9.5	8.9	7.1	....	
Brasses	70.	10.	10.	10.	....	
Brasses	74.	1.0	10.	15.	....	
Bushings	86.2	10.2	3.6	....	....	
Bushings	85.	11.	4.	....	....	
Camelia	70.4	4.2	10.2	14.7	....	Fe, 0.5
Carbon	75.4	9.7	....	14.5	....	
Carriage Wheel Bearing	84.	16.	....	....	....	
Chinese	72.5	4.7	14.3	18.5	....	
Chinese	74.	1.0	10.	15.	....	
Cocks	88.	10–8.	2–6.	....	....	
Cogs and Worms	85.	11.	4.	....	....	
Coinage	95.	4.	1.	....	....	
Cooper's Speculum	57.8	27.3	3.6	....	....	As, 1.2; Pt, 10.

This list will be continued in an early issue.—Ed.

Testing Materials Society Meeting

On Monday and Tuesday, June 25th and 26th, sessions were held at the 26th annual meeting of the American Society for Testing Materials covering Non-ferrous Metals and Alloys, Corrosion and Fatigue of Metals. The announcement of the election of new officers was made as follows: Guilliaem Aertsen, Bethlehem Steel Company, Chicago, president; W. H. Fulweiler, chemical engineer, United Gas Improvement Company, Philadelphia, vice-president. The sessions included the following papers.

REPORT OF COMMITTEE B-1 ON COPPER WIRE

By J. A. Capp, Chairman

The committee reported complete agreement of the American Electric Railway Engineers Association committee on power distribution, and specifications for hard drawn copper trolley wire. These specifications were recommended for publication as tentative. There were also prepared specifications for soft annealed rectangular copper wire, also recommended for publication as tentative. Specifications have been prepared for hot rolled copper rods which are used for wire drawing purposes with the recommendation that they be accepted for publication as tentative.

REPORT OF COMMITTEE B-2 ON NON-FERROUS METALS AND ALLOYS

By Wm. Campbell, Chairman

During the past year no new specifications have been prepared. A number of tentative standards are recommended for advancement to standard: namely,

Tentative Specifications for Pig Lead (B 29-22 T).
Tentative Specifications for Copper Pipe, Standard Sizes (B 42-22 T).
Tentative Specifications for Brass Pipe, Standard Sizes (B 43-22 T).
Tentative Methods of Chemical Analysis of Brass Ingots (B 45-22 T).
Tentative Methods of Chemical Analysis of Bronze Bearing Metals (B 46-22 T).
Tentative Methods of Chemical Analysis of Nickel (B 41-21 T).

Two new sub-committees have been formed during the year, Sub-Committee XI on Lead Pipe, Mr. W. A. Cowan, Chairman, and Sub-Committee XII on Metallic Fluxes and Deoxidizers, Mr. McKinney, Chairman.

The committee also did some work on a new type of test bar which was still under consideration. This test bar was discussed at consideerable length, especially with regard to its use for aluminum, which it was stated, could use a bar of much simpler design, and also from the point of view that such a test bar would always give much higher results than a casting from the same metal, thus causing confusion and difficulties. More detailed results will be available on this subject in the next report of this committee.

METHODS OF CASTING TEST SPECIMENS OF GUN METAL

By E. H. Dix, Jr.

This paper embodied the experience of the McCook Field foundry in casting test bars of gun metal. Fourteen methods of gating were shown and tables of results from these methods given. A method was recommended by which three bars laid horizontally in parallel were fed through a gate located at one end of the center bar feeding the two outside bars by runners, and each bar having its own riser. This method compares very well with the standard method with the advantage that it can be tested as cast without machining. Machining results in a reduction of five to ten thousand pounds per square inch in tensile strength. Specimens cut from castings may be expected to show as low as 50 per cent of the strength of the separately cast specimens. It was pointed out that the fracture of the test specimen is a better criterion of the physical properties than the microstructure. A fine gray fracture indicates high strength and elongation, and the same color mixed with light yellow indicates lower properties which are reduced in proportion to the amount of yellow structure present.

An extended discussion followed this paper. J. L. Jones criticized the various methods of gating and also stated that the test piece should be machined before pulling since the outside skin was not representative of the metal as a whole. G. H. Clamer voiced a sentiment that the test bar never was an exact indicator of the strength of the casting since the casting varied in strength with its dimensions in cross section. He recommended that some definite action be taken by the Society as to standardizing test bars and naming the degree to which it indicated the properties of the casting. N. K. B. Patch promised further information from the committee on this point at the next meeting.

THE INFLUENCE OF THE RATIO OF LENGTH TO DIAMETER IN THE COMPRESSION TESTING OF BABBITT METALS

By John R. Freeman, Jr., and Paul F. Brandt

An investigation was carried out to determine the influence of the ratio of length to diameter in compression tests of babbitt metals. The three series of compression tests indicated in the following table were made on representative tin-base and lead-base bearing alloys:

Series	Length of Specimen, In.	Gage Length, In.
A	3	3
	2	2
	1	1
B	3	2.5
	2	1.5
	1	0.5
C	3	2.5
	3	1.5
	3	0.5

The diameter of the test specimen was 1 in. in all cases. In series A the deformation was measured over the total length of the specimen by means of a vernier micrometer, while in series B & C deformation was measured by means of a compressometer mounted on the specimen.

The results of the test showed that, within experimental error, the unit deformation of babbitt metal in compression is independent of the ratio of length to diameter for specimens 1 in. in diameter and between 1 in. and 3 in. in length. This, however, was not true of bronzes.

REPORT OF COMMITTEE D-14 ON SCREEN WIRE CLOTH

By R. W. Woodward, Chairman

Committee D-14 recommended that the society accept for publication as tentative the specifications for non-ferrous screen wire cloth. The report was accepted.

REPORT OF COMMITTEE E-4 ON METALLOGRAPHY

By W. H. Bassett, Chairman

The committee offered proposed methods for the metallographic testing of non-ferrous metals and alloys, and recommended that they be accepted for publication as tentative. The committee also offered a proposed tentative recommended practice for photography as applied to metallography, and recommended that it be published

as tentative. This might possibly later be recommended for consolidation with the standard definitions and rules governing the preparation of macrographs of metals and alloys (E 2-20), but before making such recommendation the committee felt that it should be published as tentative. The committee offered the proposed revised tentative definitions of terms relating to metallography as a revision of the tentative definitions (E 2-21T) and recommended that they be accepted for publication as tentative.

CORROSION OF IRON AND STEEL

By J. H. Gibboney, Chairman

Sub-committee 3 has completed its work at the Pittsburgh location, these tests being abandoned as having served their full usefulness at the close of the inspection of March 9, 1923. It was observed that the presence of copper in all the various types of metal had greatly increased their resistance to corrosion under atmospheric exposure. It was also noted that copper added to the metals did not appear to be a factor in rust resistance when the metals were totally and continuously submerged in running water.

REPORT OF COMMITTEE B-3 ON CORROSION ON NON-FERROUS METALS AND ALLOYS

By E. C. Lathrop

This committee reported progress and stated that when sufficient information had been obtained from its questionnaire a report on specific standard methods of corrosion testing might be forthcoming.

RESISTANCE OF MANGANESE BRONZE, DURALUMIN AND ELEKTRON METAL TO ALTERNATING STRESSES

By R. R. Moore

Evidence showed that the endurance limit of non-ferrous metals cannot be determined by applying 10,000,000 repetitions of stress as is the case with most steels. This is borne out by tests in which failures have been obtained at 30, 50, 80 and even 100 million repetitions of stress.

Results were given of long time tests, that is 200 to 400 million repetitions of stress.

Polishing of specimens at the critical section was discussed.

Difficulties were encountered in adapting a type of machine and specimen (which were primarily designed for steel) to light aluminum alloys.

GASES IN METALS

By Louis Jordan

The relations between solubility of gases in metals and temperature are somewhat different from the usual conceptions of the solubility of gases in ordinary liquids such as water. Many observations lead to the conclusion that gases are dissolved in metals chiefly, if not entirely, in the intercrystalline cement.

Several examples of the supposed dependence of properties or quality of metals on their gas content are familiar in the metallurgy of pig iron, cast iron, steels, and non-ferrous metals. The application of analytical methods for gases in metals to studies of deoxidation processes has already given interesting results.

Foundrymen's European Tour

An unusually complete and attractive tour has been arranged for the party of the American Foundrymen's Association visiting the International Foundrymen's Congress and Exhibition in Paris in September. The different branches of the Institute of British Foundrymen and of the French and Belgian foundrymen's associations are making special and elaborate arrangements for the reception of the American delegation. Opportunities will be offered to visit a large number of the most prominent European foundries and manufacturing plants and to study European manufacturing and business methods under unusually favorable circumstances. In each of the principal towns to be visited considerable sums have been raised for the entertainment of the visitors. In London, the Iron and Steel Institute will be one of the hosts. Another feature will be the opportunity to visit the Shipping, Engineering and Machinery Exhibition at Olympia, London. The proceedings of the convention at Paris will include a discussion of international specifications for castings of various materials and papers on foundry practice. Sessions will be held in English as well as French.

The arrangements for the tour are in charge of Thomas Cook & Sons, Philadelphia under the direction of Stanley G. Flagg, Jr., vice chairman of the committee on international relations of the American Foundrymen's Association, H. Cole Estep, chairman.

The party will leave Saturday, August 18, on the S. S. Leviathan and will arrive in Southampton, proceeding immediately to London. There they will visit Windsor Castle and a number of the plants in the London district. Following this the party will visit Sheffield, the Peak district, Manchester, Birmingham, Stratford-on-Avon and other points of interest, technical and general.

From Wednesday, September 12, to Monday, September 17, they will attend the International Foundrymen's Congress in Paris and visit points of interest, including manufacturing plants. This will be followed by a continental tour covering salt mines in France and the American battle fronts in France and Belgium. The party will leave France to arrive in New York October 2.

Business Basically Sound, Says Judge Gary

When one considers the wealth, resources, increasing production and purchasing necessities of this country, the present business outlook is good. And this is said in the face of very heavy burdens of taxation, unnecessary and unreasonable political and social agitations precipitated by those who have nothing financial at stake, the unfortunate troubles pending in foreign countries, and the bugbear of politics.

It must be admitted that if one reads the Congressional Record when Congress is in session and visits the rooms of the Congressional Committees, where may be found organized minority groups urging propositions that have no merit, many of them with destructive tendencies, there is some ground for discouragement; but if one will turn about face and leave these circles of despondency and go out upon the farms, and in the manufactories, and along the transportation arteries, and into the active mines, one is compelled to conclude that the constructive forces of the United States are so great by comparison that the small standing army of pessimists cannot for long or to any great extent interrupt the onward march of business activity.—E. H. Gary, Chairman of the Board of Directors, U. S. Steel Corporation, in an address before the American Iron and Steel Institute, New York, May 25, 1923.

THE METAL INDUSTRY

With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER, THE ELECTRO-PLATERS' REVIEW

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EDITORIAL

THE PLATERS' CONVENTION

To repeat the praises of the convention of the American Electro-Platers' Society, just held in Providence, is hardly necessary. The eleventh annual convention was successful as are all other of the meetings of the American Electro-Platers' Society. The Society has its problems and difficulties but it is pulling together and overcoming them.

The meeting was particularly important in that a decision was made by the Executive Board to arrange for an enlarged exhibit of equipment, supplies and finishes. This means that the Society is actively going ahead into the business of running an exposition with each meeting. It is our opinion that this decision is a wise one, and we see no reason why such expositions should not be increasingly successful. Moreover, they will serve to educate the public at large to understand the work of the electro-plater and what the plating art can do. It should be pointed out, however, that in attempting this the platers should make doubly sure of the capability of the management. Projects of this sort are surprisingly intricate and even financially risky. It will be well to make sure of the responsibility and capability of those in whose charge these expositions are to be placed.

Another important event was a paper read by Charles H. Proctor, Founder of the Society and Plating Chemical Editor of THE METAL INDUSTRY, making a plea for better electro-plated products in the various industries. Mr. Proctor even suggested that the metal finishing should carry a guarantee with it. It was his desire that the American Electro-Platers' Society should go on record in support of plated products that would stand up better under the severe service which they would have to endure. Mr. Proctor suggested that a gold medal be awarded by the Society at each following convention, to the author of a paper or papers helping the advancement in the electro-deposition of metals during that year, the medal to be awarded to the paper which is judged to be of the highest value to the electroplating industry, and he also offered to contribute to the cost of this medal.

The idea, while not unheard of in other technical and scientific societies, is a new one to the platers. We believe that its value connot be questioned. It would act as a real stimulus to the members and might very easily result in extraordinary advantages to the electro-plating industry.

SOCIETY FOR TESTING MATERIALS

It is gratifying to watch the steady increase in membership of the American Society for Testing Materials. In 1921 the society had 2,908; in 1922 it had 3,030 showing an increase of 122, during a very bad business year. In 1923, with conditions considerably improved, the membership rose to 3,218, a net increase of 188. That this increased membership is the result of important work done by the society is indicated by the growth of the number of committees and sub-committees and their co-operation with other engineering bodies. Committee B-2 on Non-Ferrous Metals and Alloys has suggested the appointment of a committee on Corrosion, Resistant, Heat Resistant and Electrical Alloys. Several present standing committees will be consulted since this field is of interest to them in the work they are already covering.

An important piece of work done during the past year was the compilation and publication of a List of Alloys* by William Campbell which is now in its second printing. This List is probably the first systematic attempt in the United States to gather together all the known mixtures in use. There may be further revisions of course, but it is a long stride in the right direction.

Dr. Burgess in his annual report on behalf of the Executive Committee suggested that the society should do more to develop fully the work along the lines of the promotion of knowledge of the materials of engineering. In addition to the work of standardizing the specifications and methods of testing, this could be done by having more papers read to supplement reports of committees. Also there is under consideration a formation of a small Committee on Research whose duty it would be to review these various fields and point out wherein the society might engage in appropriate ways in certain studies. This committee would not conduct research; it would advise and recommend.

During the past year 10 standards of the society have been approved as tentative American Standards, (making a total of 24) by the American Engineering Standards Committee. In addition, 26 standards of the society have been submitted for approval as tentative American Standards, making a total of 50 standards of the society placed before the American Engineering Standards Committee. The Society has also been co-operating with the Federal Specifications Board, with the Division of Simplified Practices of the United States Department of Commerce, the Division of Engineering of the National Research Council and the American Foundrymen's Association among others.

It is planned to hold an international engineering congress in 1926 in connection with the Sesqui-Centennial Exhibition, to be held in Philadelphia. The Society will hold an international meeting during that year and is making arrangements by which this meeting can be properly made a part of the international engineering congress.

COPPER AND BRASS PUBLICITY

Since the war taught the United States the value of propaganda and since Roger W. Babson proclaimed that anything could be sold to the people provided the proper methods were followed, it has remained only for progres-

*This List is being published serially at the present time in THE METAL INDUSTRY.

sive, well-financed organizations to take advantage of this fact to improve their standing. At a dinner of the Purchasing Agents' Association, W. A. Willis of the Copper and Brass Research Association traced the history of his organization from the time that copper was used entirely for war materials, and was therefore in no position to hold its share of the industrial market to the present day.

It seems that during the war, with copper in enormous demand for munitions and commanding a correspondingly high price, industry was forced to look for other materials which would be both cheaper and in better supply. Needless to say they were found, but whether or not they were as suitable for the various purposes as copper, which they had replaced, was in many cases doubtful. In August, 1921, copper producers and fabricators of importance got together and founded the Copper and Brass Research Association, an organization for popularizing the use of copper and its alloys in those places where it had formerly been predominant and had a good chance of returning. In his speech, Mr. Willis stated that all their work had been successful beyond anything hoped for in so short a time, and he attributed this success to the potentialities of the American market, the existence of which they had not suspected. In addition, the Association has done excellent work in gaining the co-operation of dealers in keeping the retail prices of brass and copper products within reasonable limits.

That this lesson has not been wasted is proved by the fact that zinc producers have decided to spend a large sum of money on a publicity and advertising campaign to develop the uses of zinc. So long as funds are carefully administered and no attempt is made to push a material for uses for which it is not suited, these expenditures will unquestionably be worth while.

BRASS, BRONZE AND COPPER STATISTICS

On page 303 of this issue will be found Department of Commerce tables showing the trend of the brass, bronze, copper and allied products in 1921. These figures, in comparison with those published for 1919,* show a considerable decline. From 1,092 establishments, the number decreased to 911, considerably less than existed in 1909. Wage earners were even more sharply cut, dropping from 75,051 to 39,830. The figures show only too plainly the terrific slump which the metal business experienced.

It is to be noted that this industry covers the manufacture of castings and machinery fittings; plates and sheets; plain and insulated wire; tubing, seamless and brazed; rods; hardware and trimmings; ingots and bars; electrical supplies; lamps. It must be borne in mind, however, that the production of wire in this industry represents somewhat less than half the total wire made from brass, bronze, copper, etc. Moreover, so many manufacturing plants include departments which really belong to other industries that it is impossible to accept these figures literally. Their main use is for comparison with former years as an indication of the trend of the industry. The tables as given relate to establishments which are engaged in the manufacture of metals as their chief business. There is no doubt that a considerable amount of brass, bronze and copper is manufactured in plants which are engaged primarily in steel working.

The statistics are necessarily a year or two behind, and therefore do not show the subsequent revival in 1922. It is, of course, well known that the industry did not remain at this low ebb but has come back to a considerable portion of its rated capacity.

The leading state in point of importance in this industry is still Connecticut with over 30 per cent of the distribution. Others are as follows: New York, 15 per cent; Michigan, 12 per cent; Pennsylvania, 8.6 per cent; Ohio, 7.2 per cent; Illinois, 5.3 per cent; Massachusetts, 3.2 per cent; New Jersey 3 per cent; Wisconsin, 3 per cent; Missouri, 1.9 per cent; Indiana, 1.5 per cent.

*See THE METAL INDUSTRY, September, 1922, pages 371-372.

TRADE PRACTICES

The trend of the times is combination and standardization, not necessarily of business organizations into one large operating unit, but rather in the sense of the co-operation of these organizations while still working independently. Trade associations have been the outstanding means of accomplishing this end and, with the exception of those who have run afoul of the Federal Trade Commission and the Department of Justice, they have served a notably good purpose.

It is hard to see why any industry should be unorganized. It is not merely the business of holding up prices, but the simplification of useless varieties, the standardization of trade practices, the education of the members to economics and its relation to their individual businesses that are the important functions of trade associations.

Nothing could be more suitable to an association's work than the list on standard practices put out by the Electric Steel Founders' Research Group of Chicago. Metal manufacturers would do well to read the following list and to profit by its example.

1. Suitable pattern equipment for economical molding shall be furnished by customer.

2. The foundry will not be responsible for correctness of pattern equipment to blueprint, except when such equipment is made for the customer under the supervision of the foundry.

3. Repairs on pattern equipment shall be paid for by the customer, except when occasioned by carelessness on the part of the foundry.

4. Patterns must have distinctive colors to identify separately the coreprints, machined surfaces, and rough casting.

5. All patterns, coreboxes, and loose pieces thereof, must be properly numbered for identification.

6. All transportation charges on pattern equipment to and from foundry, shall be paid by the customer.

7. The foundry will not carry insurance on customers' pattern equipment.

8. Free replacement will be made of defective castings if reported and returned to foundry within a reasonable time.

9. The foundry will not be responsible for any expense on defective castings, incurred by the customer.

10. The customer will be charged with the cost of molds and cores discarded by the foundry, due to change in patterns or coreboxes.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

Clean Up the Plating Shops

Some Observations to Job Plating Shops and Suggestions That Might Lead to Betterments

To the Editor of THE METAL INDUSTRY:

Visiting the shops of the metal finishers has always been one of my habits and when I came to the Pacific Coast fresh from the East, where I had a personal acquaintance with many of the proprietors of really big and successful shops, I wondered if I might find things different here. On investigation, I found shops here very much as they are in the East, but, if anything, not so well equipped to handle big work. This, however, was not what impressed me. The defects in the trade are not answered here, and in neither East nor West have I found a shop conducted exactly as I would wish it to be.

Now it occurs to me that if I have a real idea it would be proper to give that idea to the readers of THE METAL INDUSTRY and in that way get it over, and do the trade some good.

The business of finishing metal is not different from any other trade or profession which renders a service to the public and in return receives a profit. Some trades may return a better remuneration and be more pleasant to engage in, but these matters adjust themselves.

Our trade is a necessity. It is neither a luxury nor one that may be passed lightly by, and its success is growing with a wider use of its service as the progress of civilization advances.

May I first tell my impressions of an ordinary shop?

I was walking along some insignificant and slightly traveled side street and found a sign of small size and crudely lettered, which hinted that here is a finishing plant, and I walked in. It was a small dingy room with packing cases in the way and a cheap kitchen table with a broken chair against the window which had not been washed since before Kaiser Bill started his trouble. On the wall was a card on which was scrolled, "If you want anything, ring the bell." I sat down and pictured the individual who would come and wait upon me. Presently I rang the bell and waited. After a lingering wait, out he came, a burly man with a three-days' growth of beard on his face and a gunny sack over his stomach, with wooden-soled shoes and his arms dirty and dripping with water.

"What did I want?" left me little to say. What I wanted was something he could not supply and that was a real trade talk about trade conditions, and all I could say was that I came to see how business was and learn if he read THE METAL INDUSTRY regularly.

He answered something like this: "I'm too busy to waste any time reading them papers and I don't take any and don't want to." Then I asked him about his work. Was he busy? He told me that he had a job of nickeling 2,000 radiator caps for a local automobile factory and that he had to get the job out in two weeks more and didn't want any more business now and would have to work at nights to finish this job. He had no time to discuss matters in which he had no interest.

Then he turned to go and I did not detain him for the shop and its proprietor were but a duplicate of other shops of the same kind in every industrial city and all through the trade wherever I had visited.

In this business that annually employs thousands of workers with investments of millions, and the use of many more millions worth of material and raw products, with many firms engaged in the metal work, we should lift up our heads and face a much brighter future.

It seems to me that we are not getting out of the business all that we should; that the business started as a labor and has continued along this line rather than as an art. Many of the men who have shops are not keeping step with progress; they do not learn the better way of doing things; they are not installing the later methods of saving time. The worst fault of all, however, is that they are not educating the public to the proper recognition of the trade. To the public generally, the trade is a mystery and I feel that the owners of the shops are willing to have this thought continue. Why, I don't know. But it is being done at a tremendous cost and should cease.

It is my belief that you can enter any home and find a hundred things there that require refinishing, all through the home, in every room, from the door knobs and name plate on the front door to the garage in the rear. Little of this work finds its way into the shops and the fault is that the shops are making no effort to make it come in. This is the day of sanitation, and every home of today is conducted along the line of cleanliness, looking to comfort and beauty. I sometimes wonder why the trade does not put some clean, smart-faced girl on the street to call on the homes to discuss this matter, to show samples of things that were and are now better because we refinished them. To visit the home and call attention to the chandelier, the plumbing fixtures, the kitchen utensils, the smaller objects that need refinishing and the beds that should be made over.

I wonder why some shop does not select a location so that the public can find it easily instead of hiding down some dark side street, and then I wonder why some one in the trade does not try to get the public, the housewife, to learn that our business is one that is making the world brighter. If we do this and will let the housewife know it, she will be making a well-worn path to the shops and sending her neighbor.

Another thing, I have never yet read an advertisement in the daily paper that tried to show the public how to find the place that refinished the things of the home. If our trade is so poor that it cannot afford to advertise, then we need to raise our prices to the point where we can. Other lines are advertising necessities for the homes and they are succeeding.

And now let me speak of that dirty, little, unkempt shop I mentioned in the beginning. This condition is hurting the trade more than anything else. CLEAN UP. CLEAN UP. CLEAN UP. I don't know how to make the matter stronger. I do know that when we ask some dainty housewife to clean her home and make things better, we should clean our own shops first before we ask her to come with her work.

A good clean office does not cost much. Put the rubbish out in back. Put in a real table. Put some curtains at the windows and put a rug on the floor. Put some samples in a case and get some printed matter to keep a record of the job. Then if you can, get your daughter or some one else's daughter to put on a gingham dress and wait on the trade. The saleswomen outside will bring the business. You take care of it. Do not promise delivery until it will be ready and then do a GOOD JOB at a right price and send all customers on their way satisfied.

This trade of ours has been in the shadows too long. It is time that it came out into the light. It is time that we took from it some of the mysteries. It is time that we waked up to the bigness of the business and got some profit from the work.

One idea I had was that a board about two by three be covered with some black velvet or similar fabric and that on it be mounted some samples of common things, such as a kitchen knife before and after finishing, and several articles that would show just what refinishing meant to the housewife. This board should be sent to the local hardware man and he should put it where his customers could see it. He also wants a profit and this will give him some, for he will take orders that you never heard about.

Let us get some discussion on this matter and see if we can't put the business on a higher plane. I have visited many shops and this is my impression. It must impress others the same way. It is your business. Clean it up and get a profit from it, and then when you find some new idea, write to THE METAL INDUSTRY and tell the other members of the fraternity.

J. W. MUSSELMAN.

Oakland, Cal., June 4, 1923.

DISCUSSION ENDS IN AGREEMENT

I note that you suggest the discussion between Mr. Proctor and myself end, and I agree with your editorial comments that it is truth and not victory that should be the end in view, and that in all lines men differ in their opinions. I think in fairness to Mr. Proctor and myself it should be pointed out that according to Mr. Proctor's last article wherein he explains that the 24 amperes per dozen, he suggested, was not intended to be used with the solution for which he gave a formula—this explanation removes the objection I made; hence, we are in accord.

I admit I reluctantly accept his last explanation since, in his previous articles, he has been defending a contrary position, or there could have been no discussion, but it is a harmonious way out of a difficult position without the admission of error. But the truth is now admitted by both of us, that the current density and solution under discussion cannot be used together.

I think this little note should be published in your paper.

F. C. MESLE, Editor,
Sherrill, N. Y., June 16, 1923. The Monthly Review.

New Books

Nos Usines **Métallurgiques Dévastées—1914-1918—or in our own vernacular: The Devastation of Our Factories During the Great War. Published by the Revue de Metallurgie, 1921. 234 pages, quarto, with chapter contents in French, Spanish and English. Price 25 francs, in paper covers, stitched. Add one franc for postage.**

Of all the French industries which suffered by the war, the metal industry is undoubtedly the one that suffered the most; as a direct consequence its capacity of production was greatly impaired.

The object of the present publication is to place on record both by actual figures and views, the damage done to the large establishments of France and the progress hitherto made in the work of reconstruction.

A table shows that of the number of men killed and missing, Great Britain lost 63% and the United States 8.3%, respectively of the French losses.

The French territory was invaded to the extent of 8,895,000 acres for a period of four years and the districts occupied were the most important of the country both as regards the natural wealth and business. Maps are published to show what portion of the French invaded sections would occupy both in England and the United States. At the time of the armistice 11,500 French works had been destroyed, 319,269 private dwellings had been razed to the ground, and an additional number of 313,675 were partly demolished; 32,500 miles of railways, 24,400 miles of roads, 1,000 miles of canals and 4,875 bridges and viaducts required reconstruction and relaying. All of these devastations were by no means due to military requirements, a large portion were systematically and deliberately planned and executed by the invader, with the sole object of ruining French industries and thus after the war to gain easily and quickly a marked economic supremacy. Everything the enemy could not remove to Germany, as plunder, was wantonly destroyed by sledge-hammer or by explosive charges, some of this destruction having taken place a few days only prior to the armistice. The total quantity of material and machinery in the iron and steel trade that was destroyed is stated in an annex.—R. E. Search.

Metal Statistics. Published by the American Metal Market. Size 4 x 6—512 pages. Price payable in advance, $1.00. For sale by THE METAL INDUSTRY.

This is the 16th annual edition and contains the standard statistical information which has been supplied in the past. Chapters of particular value to those interested in metals are as follows: Copper; Tin; Lead; Zinc; Aluminum; antimony; nickel; silver; platinum metal; miscellaneous. The figures cover the items of production, consumption, imports, exports, prices and stocks.

Inorganic Chemical Synonyms, by E. R. Darling. Published by D. Van Nostrand Company. Size 4½ x 7½—126 pages. Price, payable in advance, $1.00. For sale by THE METAL INDUSTRY.

A very useful little handbook for those who are in any way concerned with the chemical trades. It has long been one of the difficulties, at least, of the uninitiated, to recognize a material by its numerous names. This book covers the subject briefly and fills a read need. Chemical synonyms are given for the following elements and their compounds: Aluminum, Antimony, Arsenic, Barium, Bismuth, Cadmium, Calcium, Chromium, Cobalt, Copper, Hydrogen Compounds, Iron, Lead (Plumbum), Magnesium, Manganese, Mercury (Hydrargyrum), Nickel, Potassium, Silver, Sodium, Zinc.

Engineers' Handbook. Published by the Lumen Bearing Company. Size 5¼ x 7¾—117 pages. Price, payable in advance, $1.00. For sale by THE METAL INDUSTRY.

Although the handbook is frankly put out as descriptive of the products of the Lumen Bearing Company, it has been made of much greater value than a mere catalog. A great deal of useful information and data on non-ferrous alloys as applied to bearings and other general uses is included. Compositions and physical properties on a number of alloys are detailed and also methods of testing. A very interesting technical discussion of bearings is included with much valuable information to the machine designer.

Industrial Furnaces, by W. Trinks. Volume I. Published by John Wiley & Sons. Size 6 x 9—319 pages. Price, payable in advance, $4.50. For sale by THE METAL INDUSTRY.

The volume, it is stated, deals with the principles which underlie all industrial heating operations and furnace design, and with all those applications which are independent of the nature of the fuel or energy supply. A large number of graphs are included, which show at a glance, the relations between the many variables, and which shorten furnace calculations to such an extent that science can be applied where guess work has formerly been used. Numerical examples, illustrating every principle and method of calculation, are also given.

Although much of the work covered applies to steel and iron, nevertheless, the general principles of furnace construction and manufacture apply to all metals. Hence the book will be found valuable to the designer and also the operator of furnaces working on metals outside of iron and steel. The contents of this volume are as follows: Heating Capacity; Fuel Economy; Heat Saving Appliances; Strength and durability; Movement of Gases.

Transactions of the American Foundrymen's Association. Volume XXX. Edited by E. L. Shaner and R. E. Kennedy. Published by the American Foundrymen's Association, Chicago, Ill. Size 6 x 9—887 pages.

The annual collection of papers presented at the annual meeting, Rochester, N. Y., (in this case, the one held in 1922) and also the proceedings of that meeting. Those papers relating to metals have been reprinted, either in full or in abstract in THE METAL INDUSTRY.

GOVERNMENT PUBLICATIONS

Production of Refined Primary Lead in the United States, by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Fluorspar in 1922. Hubert W. Davis, U. S. Geological Survey, Washington, D. C.

Fuel Briquets in 1922, by W. F. McKenney, United States Geological Survey, Washington, D. C.

Cadmium in 1922, by C. E. Siebenthal and A. Stoll, U. S. Geological Survey, Washington, D. C.

Production of Platinum and Allied Metals in 1922, U. S. Geological Survey, Washington, D. C.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical; WILLIAM J. REARDON, Foundry; PETER W. BLAIR, Mechanical; LOUIS J. KROM, Rolling Mill; CHARLES H. PROCTOR, Plating-Chemical; R. E. SEARCH, Exchange-Research

BENEDICT METAL

Q.—Will you kindly give us the formula for the Benedict metal mixture as we have an order for fittings to be made of this metal. Kindly give us all information as to the temperature required to melt this mixture, the running of same, etc.

A.—Benedict metal, as it is called, consists of 80% copper and 20% nickel. For casting in sand consists of 85% copper, 14% nickel and 1% of 30% manganese copper.

This mixture is very difficult to handle in the foundry, and considerable skill is necessary to bring about satisfactory results. A good melting furnace is necessary, the best is the crucible furnace, and the temperature required to cast is approximately 2,500° F.

The methods used are as follows: First a layer of charcoal is placed in the crucible, then add some scrap metal of this mixture, and then add the nickel on top of the scrap. If no scrap is used, add one or two ingots of copper, then add the nickel, and when all is melted add the balance of the copper and bring to a white heat and then add the 30% manganese copper.

In preparing the mold it is necessary to use a facing. One that has been used with success consists of 4 parts new silica sand and 2 parts of old silica sand, 1 part of sea coal added to 8 parts of the above. 1 part of flour to 4 of the above. Fire clay 1 part to 24 of the above. Dry the molds in a core oven and paint, or blow a mixture of black lead and molasses on the mold to close the pores and give the casting a good skin.

Use large gates and risers and make molds similar to molds for manganese bronze. Pour as hot as possible.—W. J. R. Problem 3,211.

BRASS CASTINGS

Q.—We have an order for quite a number of small red brass castings, 85-5-5-5, about 3 oz. in weight. The castings don't come smooth enough. We are using No. 2 Albany sand.

As we understand it, there seems to be something new on the market in the line of a permanent mold for work like that, and the molds would be good for 500 to 1,000 castings before renewing.

A.—We do not know of any new process mold on the market which will last for 500 to 1,000 castings before being renewed. In the mixture of metal you are using we do not think it would be possible to cast in any form of a permanent mold.

For small castings there is, however, a process where a mixture of from 55% to 65% copper and the balance zinc, with from 4 oz. to 16 oz. aluminum added, is cast very successfully in a plaster mold, and the casting comes out of the mold like a finished casting. However, the mold must be renewed after each casting.

For your small castings, we would recommend you try the following mixture: 86% copper, 3% lead, 3% tin and 8% zinc.

Make the alloy from new metal. Use ingot copper and new zinc. Flour the mold well after drawing the pattern and blow off all excess flour, and you should obtain the results you are looking for.—W. J. R. Problem 3,212.

FLEMISH FINISH

Q.—What is the Flemish finish?

A.—The Flemish finish is an antique brass finish as applied to chandelier or similar products. Almost any type of black deposit from immersion dips or plating solutions that will give a bright gray black is suitable for Flemish finish. The black finish, so deposited, acts on the base finish. It should then be scoured away with a tampico wheel and pumice stone **in part** to show a brush brass and black effect. Afterwards the articles so finished should be lacquered as usual.

No. 1. Electro Arsenic Black:

Water	1 gal.
Caustic soda, 73-76%	5 ozs.
White powdered arsenic	10 ozs.
Sodium cyanide, 96-98%	1 oz

Use part of the water warm. In preparing the solution dissolve the caustic soda first, arsenic next. Then the cyanide. Add the balance of the water. Anodes of steel, carbon or nickel may be used. Voltage 2 to 4.

No. 2. Electro Arsenic Iron Black:

Muriatic acid	1 gal.
White powdered arsenic	12 ozs.
Carbonate of iron	12 ozs.
Water	2 qts.

Heat up the acid to 140° Fahr. Dissolve the arsenic therein. Add the water, then the carbonate of iron. Mix thoroughly in anodes of nickel or carbon. Voltage 2 to 3.

Immersion Black:

Water	1 gal. temp. 160° F.
Caustic soda, 73-76%	5 ozs.
White powdered arsenic	2½ ozs.
Sodium cyanide, 96-98%	2 ozs.

Prepare the solution in the order given. Use as a dip. Only articles that are clean and made from brass will become black in a few seconds. When immersed in the solution maintain at 180° Fahr.

If part of No. 2 solution is added to hot water, say, 180° F., about 4 to 8 ozs. per gallon of the combined muriatic acid, arsenic and iron, then the solution may also be used as a dip solution as outlined.—C. H. P. Problem 3,213.

FOOT BRACE METAL

Q.—We are having considerable trouble with spring steel which we use in the manufacture of our foot supports and braces, on account of corrosion caused by perspiration of feet. Therefore, I am writing to you to find out what metal would be the best substitute to use in the place of steel for the manufacture of braces in the hospital.

The metal must have the following qualities: It must be light, as nearly non-corrodible as possible, and one that can be worked cold, as it is our intention to stamp out our plates in the future. The advantage of the spring steel over other metals is due to the fact that the plate would give slightly under the weight of the body at each step. If this characteristic is present in any non-ferrous metal we should be glad to make its acquaintance.

A.—We would suggest Monel metal or pure nickel sheet for your use. Both can be worked cold and possess some spring. These metals are non-corrodible, and are used extensively in hospital work. If a light alloy is desired it may be that cold rolled sheet aluminum would answer the purpose.—W. J. R. Problem 3,214.

GEAR BRONZE

Q.—We have an inquiry for considerable quantities of gears, and they are to be made of bronze. I have made some of different bronzes, but they do not come up to the standard. These gears and worms are used in gear boxes for reductions in speed. Could you let me have a mixture for this purpose?

A.—The alloy used for worm drive gears is composed of 89% copper and 11% tin, and is known as English gear bronze. Another mixture used considerably for gear blanks is composed of 90% copper and 10% aluminum. Differential gears are made mostly from steel. However, if bronze is desired we would suggest the 90% copper and 10% aluminum mixture.—W. J. R. Problem 3,215.

HAND HAMMERED COPPER

Q.—We have lately begun the business of hand-hammered copper and would like some information as to the methods used for oxidizing copper. We would appreciate any information you can give us as to a good low quality easy flowing hard solder for copper, something a little lower grade than silver solder; in fact, it should be quite a bit easier flowing than silver solder.

A.—In the finishing of hammered copper articles to produce an antique finish, the black oxide of copper that forms in annealing is left on the copper, and when the articles are completed the black oxide is removed as desired, either with pumice stone and oil or pumice stone and water, or other similar abrasives.

If the black oxide is removed in fabricating the articles, the outer surface should be scoured down with pumice stone and water when completed, then washed thoroughly and immersed in a solution consisting of:

Water	1 gal. temp. 160° F.
Sulphuret of potassium or polysulphide	⅛ to ¼ oz.
Water ammonia, 26%	10 drops

As soon as a bluish black is formed on the copper, remove the articles from the dip, wash thoroughly and then scour down as desired with pumice stone and water or oil.

When brown or reddish bronze tones are desired do not immerse until the blue black tone is developed. Remove as soon as an iridescent brownish black tone develops. Wash afterwards in water and dry out thoroughly, then scratch-brush with a brass wire scratch-brush. This method will give you the Japanese bronze finish. By manipulation you can obtain a variety of bronze finishes.

No. 2—

The usual silver solder is composed of the following:

Fine silver	18 parts by weight
Shot copper	4 " " "
Zinc	1 " " "

A more fusible solder can be produced from

Fine silver	5 parts
Common yellow brass	5 "
Zinc	5 "

A very common easy flowing solder may be prepared from

Fine silver	1 ounce
Shot copper	6 pennyweights 12 grains
Zinc	2 " 9 "

—C. H. P. Problem 3,216.

METAL FOR BRONZE MOLDS

Q.—Could you inform me of a good brass or bronze mixture for molds to cast soft metal in? Am making some molds for a casket concern in which they cast a mixture of lead and antimony, but have trouble with them because after using a short time they crack.

A.—A metal has been found very satisfactory for this class of work, will not crack or scale, consists of: 88% copper, 10% aluminum and 2% iron. This mixture has a very high shrinkage and must be molded with a large riser and long runner gates.

The best way to prepare the above mixture is to take 2 pounds of tinned scrap iron, such as can be found in any tin can plant, and charge in the bottom of the crucible with a small amount of charcoal. Add the copper on top of the iron, smelt and get good and hot, then add the aluminum a little at a time. Stir well and pour in ingots, and remelt ingots for casting molds.—W. J. R. Problem 3,217.

METALLIZING SHOES

Q.—How can I metallize babies' shoes?

A.—The methods used by platers as a rule in metallizing babies' shoes are as follows:

1. Coating with two thin coats of orange shellac varnish. 2. When dry, spray two thin coats of copper bronze. Powder mixed with bronze lacquer medium. The lacquer medium can be purchased from any reputable lacquer manufacturer, a number of whom are advertised in THE METAL INDUSTRY. 3. When the copper bronze surface is thoroughly dry, wire up the shoes carefully with soft copper wire about 18 or 20 B & S gauge. 4. Plate in an acid copper sulphate solution at 1 to 2 volts, prepared as follows:

Water	1 gallon
Pure Copper Sulphate	1¾ lbs.
Pure Sulphuric Acid	4 ozs.
Aluminum Sulphate	1 oz.
Transparent gelatine	1/64 oz.

9 Use soft sheet copper as anodes. We are of the opinion that if the leather shoes are coated with a black asphalt varnish uniformly and when the varnish is partly dry or tacky, similar results as outlined will be obtained. The advantage of the asphaltum varnish is that it will make the leather waterproof and impervious to water or solution. The usual copper bronze powder is applied uniformly with a soft brush, asphaltum air drying varnish can be used.—C. H. P. Problem 3,218.

ORNAMENTAL OBJECTS

Q.—Can you give me the name of a book giving information on the making of bronze moulds for the casting of ornamental objects such as incense burners, book ends, etc? Can you give me information where I can get some knowledge of finishing these objects by the spraying method?

A.—There is no text book that we know of that will give the desired data covering the making of bronze molds adapted to casting articles from antimonial lead or zinc. Mold making is an expert trade and in our opinion it would be much cheaper to purchase molds from a regular mold maker. The American Chasing and Modeling Company, 145 East 23rd Street, New York, specializes in the manufacture of such molds direct from models that may be furnished. Lacquer manufacturers advertising in THE METAL INDUSTRY retains a corps of experts who could give you all information desired covering the finishing of objects you mention in bronze or pigment lacquer. Spray manufacturers also advertise in our journal.

We are unable to answer your letter directly as your letterhead did not give the city in which you are located. Please write us again giving your full address.—C. H. P. Problem 3,219.

PITTED BRASS CASTINGS

Q.—We wish you would advise what is causing the trouble we are having with our castings in our foundry. We are using various sands and each mold is dried. We have been trying to get out a dozen patterns of a certain shape, with which we should have no trouble in running the metal, and out of about 50 or 60 castings we have not been able to get twelve which we could use. They seem to run up, but the surface is pitted and full of small holes, and when these are turned down for patterns, we find the same condition underneath.

A.—You state the molds are dried and Garden City sand is used. Therefore, the trouble cannot be in the molding and must be in the composition of metal used, or the treatment the metal receives in melting.

We suggest you try the following mixture, as you also use these same castings for pattern work: 86% copper, 3% tin, 3% lead and 8% zinc. Use new metal and melt in a crucible. Charge the copper with a small shovelful of charcoal, get the copper good and hot and add ¼ of the zinc, then add the lead and tin. Stir well and then add the balance of the zinc. Just before pouring, add a small spoonful of salt. This composition should give you the desired results.—W. J. R. Problem 3,220.

TUMBLING BARREL

Q.—We are enclosing a sample of the piece of brass we desire to polish. As we haven't got a very large quantity to be made, we would appreciate if you will let us know if it is possible for us to make one of these barrels ourselves. We do not wish to spend too much money on a steel tumbling barrel.

A.—You can use a wooden oblique tumbling barrel of your own construction if you so desire, to ball burnish the brass articles as per sample. Half of an ordinary alcohol barrel would answer your purpose. It should be provided with a tightly fitting cover, and should be run at not less than 60 revolutions per minute. A good-sized wine keg could also be used. It would be advisable to rotate such a keg horizontally with an oscillating motion, so that there would be a double motion. Plenty of balls about ¼ inch in diameter should be used to prevent the brass parts from coming too often in contact with each other.

Your burnishing medium could be neutral soap chips dissolved in water in the proportion of ½ ounce per gallon or more, or the same amount of whale oil soap.

After ball burnishing, the brass parts could be tumbled in scrap kid and sheep skin leather with a little Vienna lime as the polishing medium. These methods should give the desired results.—C. H. P. Problem 3,221.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

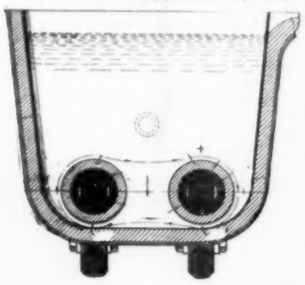
1,452,810. April 24, 1923. **Apparatus for Testing the Hardness of Metals and Other Materials.** Harold Moore and Richard Mather, Woolwich, England.

Apparatus for testing the hardness of materials comprising a support for the specimen to be tested, a hardened steel ball arranged above said support, a stirrup carrying said hardened steel ball adapted to carry a known weight and means for lowering said stirrup so that said ball is pressed into contact with said specimen under said known load.

1,453,080. April 24, 1923. **Soldering Flux.** Harry A. Pallady, Seattle, Wash.

A soldering flux comprising zinc chloride 44.44%, tin amalgamated 33.33%, sal ammoniac 21.90% and glycerine .33%.

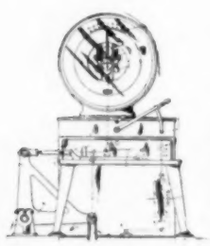
1,453,097. April 24, 1923. **Multiple-Unit Induction Furnace.** Charles B. Foley, Bristol, Conn., assignor to Charles B. Foley, Inc., New York.



An electric furnace, comprising a receptacle of refractory material, having interior walls forming channels, and independent current-inducing means linked with said channels said current inducing means being so connected as to produce secondary electromotive forces of the same direction.

1,453,254. April 24, 1923. **Alloy and Process of Making the Same.** Allen B. Norton, Cleveland, Ohio, assignor to Aluminum Manufacturers, Inc., Cleveland, Ohio.

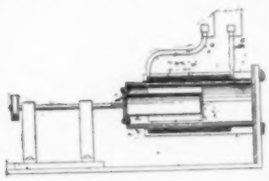
The process of making an alloy containing aluminum and metals having relatively high melting points as compared with aluminum, which comprises melting the aluminum, adding a high melting point metal in solid form to the molten aluminum and then adding a high melting point metal in molten form to the molten aluminum.



1,453,355. May 1, 1923. **Wire-drawing Scale.** Halvor O. Hem, Toledo, Ohio, assignor to Toledo Scale Company, Toledo, Ohio.

In wire drawing apparatus, a movable member adapted to engage a wire being drawn and a force measuring instrument operatively connected to said member to indicate the force exerted in moving said member.

1,453,358. May 1, 1923. **Process of Joining Metals.** Charles F. Kettering, Dayton, Ohio, assignor to General Motors Research Corporation, Dayton, Ohio.



The process of joining metals which comprises placing the metals in proper relative position together with suitable bonding materials and heating the assembly by generation of heat within the body of one or more of the metals.

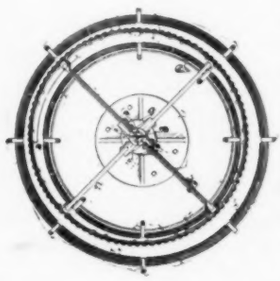
1,453,928. May 1, 1923. **Aluminum-Silicon Alloy and Method of Making It.** Junius D. Edwards, Oakmont, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.

In the art of making articles of an aluminum alloy containing a substantial amount of silicon, the improvement comprising incorporating in a finely divided state in the molten alloy a metalloid of the fifth group of the periodic system of the elements, having an atomic weight greater than 100, and thereby, favorably affecting the strength and ductility of the resulting alloy.

1,454,064. May 8, 1923. **Process of Casting Metals.** Hubert A. Myers, Toledo, and Arteemes D. Straw, Wauseon, Ohio, assignors by direct and mesne assignments to the Hubert A. Myers Company, Toledo, Ohio.

The process of preventing adherence of a metal casting to a mold, which consists in treating the mold with a metalliferous substance and forming between the mold and the casting, a gas from the metalliferous substance by the heat of the metal cast.

1,543,419. May 1, 1923. **Electroplating Apparatus.** Wilfred Thompson and Walter R. Jameson, Niagara Falls, N. Y., assignors to Wm. A. Rogers, Limited, Niagara Falls, N. Y.

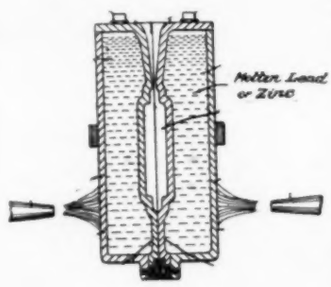


An electroplating apparatus comprising a tank adapted to contain an electrolyte, a support upon which the articles to be plated are suspended in said electrolyte, and means for moving said support lengthwise and also crosswise relative to said tank.

1,454,065. May 8, 1923. **Mold for Casting Metals and Process of Making and Using the Molds.** Hubert A. Myers, Toledo, Ohio, assignor to the Hubert A. Myers Company, Toledo, Ohio.

In a mold for casting metals, the fold formed of ingredients comprising a nickel cobalt metal.

1,454,066. May 8, 1923. **Mold and Process for Casting Materials.** Hubert A. Myers, Toledo, Ohio, assignor to the Hubert A. Myers Company, Toledo, Ohio.



In a mold for casting materials, the mold having a chamber and a molding cavity, a wall separating the chamber and the cavity, the chamber containing a material having a boiling point above 1,000° F.

1,454,067. May 8, 1923. **Container and Mold for Molten Metal.** Hubert A. Myers, Toledo and Arteemes D. Straw, Wauseon, Ohio, assignors to the Hubert A. Myers Company, Toledo, Ohio.

An iron mold for casting metals having zinc distributed over its matrix surface.

1,454,068. May 8, 1923. **Protective Material for Molds and Method of Forming the Same.** Hubert A. Myers, Toledo, and Arteemes D. Straw, Wauseon, Ohio, assignors to the Hubert A. Myers Company, Toledo, Ohio.

A container having metal incorporated therein and for containing molten metals, and having a protective coating comprising carbon, iron and an oxide of a metal gasifiable below the melting point of iron.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

NEW PLANT OF E. W. BLISS COMPANY

The E. W. Bliss Company of Brooklyn, N. Y., have recently moved their sales and executive offices to their South Brooklyn plant, located at the foot of 53rd Street, on the east shore of Upper New York Bay. This plant comprises a group of seventeen buildings covering a ground area of eighteen acres and has a total floor area of twenty-one acres. It has a water frontage of 300 feet at which there are two piers, one being 200 feet long and 80 feet wide and the other 575 feet long and 60 feet wide. There is ample water to accommodate the average size steamship.

The accompanying aeroplane view gives a very good idea of the size of the plant, which is 5 feet less than one-half mile long. Beginning at the Second Ave. end of the plant which is shown in the foreground of the picture there is a three-story machine shop, 320 feet by 200 feet, constructed in the form of a hollow rectangle, the court of which is 200 feet by 80 feet and is used as erecting shop while the balance of the building is used as a machine shop. The erecting shop is served by a number of electric traveling cranes and auxiliary hoists. On either side of the building are five ton steel cranes to serve the planers and lathes.

Next in the picture is the hydraulic forge shop, which is a one story building 125 feet and 200 feet wide and is served with two 10 ton and one 30 ton overhead electric traveling cranes. The equipment in this shop consists of furnaces, steam hydraulic forging hammers and forging presses ranging from 200 to 1,000 tons pressure. The water supply and pressure is obtained by eight hydraulic pumps each being driven directly by one 350 H. P. General Electric motor which in turn supplies two 16" 200 ton accumulators. The pumping equipment is controlled by an automatic switchboard which is operated by the position of the accumulators.

Next in order is the automobile die department, a one-story concrete building 200 ft. by 180 ft. and the last shown in this block in the picture. A storage yard having a railroad siding completes the space in the block between 2nd and 1st Avenues. This yard is used chiefly for loading and unloading of cars serving the group of buildings above described, a 5-ton locomotive crane being used to accomplish the purpose.

On the far side of 1st Avenue is a one-story brick and steel building 320 ft. by 200 ft. This building is fitted with numerous skylights which give an ideal lighting condition within. Between this and the seven-story building at the center of the picture are various minor buildings such as plating, pickling, grinding, and small tool houses, also two 100,000 gallon fuel oil storage tanks. This is the primary supply of oil for the boilers and furnaces used throughout the plant and is fed by a main line running from the pier to these tanks so that they may be filled directly from the barges.

E. W. BLISS COMPANY, BROOKLYN, N. Y.

Prominent in the rear of the picture is the seven-story machine shop and erecting shop. The machine shop itself is a brick and steel building 380 ft. by 60 ft. The first two floors are served by five-ton overhead electric travelers, both the lower stories having been made sufficiently high to accommodate these tools. The entire building is used for manufacturing purposes.

Immediately to the left and adjoining this building is the main erecting shop, having an 80 ft. span and being 380 ft. in length with clear overhead distance of 50 ft. and in which are housed all of the large planers up to and including those having 12 ft. capacity and 26 ft. stroke. The main erecting floor and the machine tools are served by four overhead electric travelers, two of which are 50-ton capacity and two of which are 30-ton capacity, each equipped with auxiliary hoists.

Beyond this building and up to the bulkhead line is the main foundry which is 240 ft. long and 180 ft. wide. The foundry obtains its iron from two 84" and 54" diameter cupolas. The equipment includes three core ovens 20 ft. wide, 30 ft. deep and 10 ft. high, (oil fired) sand mixers, jolt ramming machines and four-ton wall travelers. In the center of the foundry there is a pit properly water-proofed, 60 ft. long, 14 ft. wide and 10 ft. deep, which is used for making deep castings. This foundry being built at tide water level, it was necessary to construct such a pit to exclude water from the molds.

The half block line of buildings on the right of the picture begins about half way between 2nd and 1st Avenues with various minor shop buildings, having an area of 10,000 square feet.

Again crossing 1st Ave. on this block are house various activities, including blacksmith and drop forging shops, pipe shop, lathe department, machine shop, coppersmith shop and various other general machine working departments. In the foreground is shown the steam power plant and high pressure air equipment, also a salt water pumping station which gets its supply from New York Bay from a 36" main. Salt water is used for condensing purposes and flushing and cooling throughout the plant. This station also includes one 1,000-gallon electrical and one 1,000-gallon steam fire pump which is connected to the sprinkler systems throughout the entire plant. The fire system is further provided with two four-way Siamese connections on the pier bulkhead for connection with fire boats.

The rectangular tower at the top of the seven-story building contains one 50,000-gallon sprinkler tank and one 25,000-gallon mill supply tank.

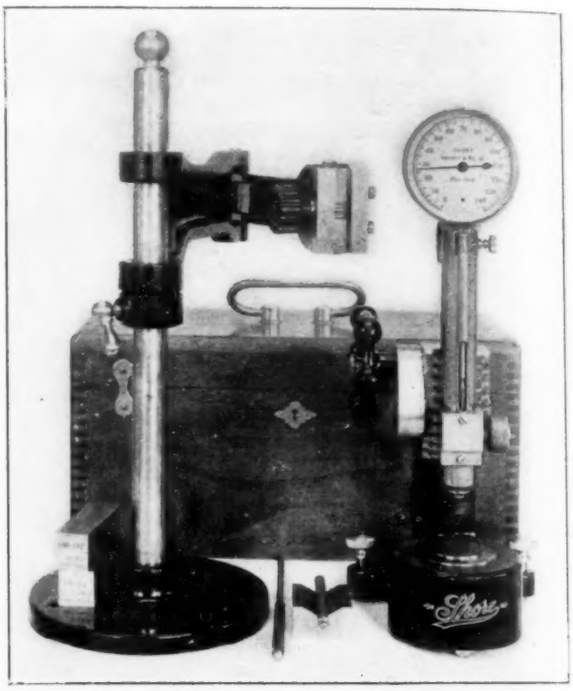
NEW SCLEROSCOPE ATTACHMENT

The Scleroscope, made by the Shore Instrument and Manufacturing Company of Jamaica, N. Y., which has long been in general use for measuring the hardness of metals, is now provided with permanent indicating mechanism, a pointer hand and graduated dial. This feature is to be contrasted with the original Model classified as Model C-1, in which the vertical graduated scale is used and against which the height of the rebound of the hammer indicating the hardness is read.

The improved dial instrument is known as the "Model D Recorder," for here, instead of the indication being momentary, the hand remains fixed an indefinite length of time, or until the next test is made. The mechanism employed consists of the usual drop hammer. The function of this hammer is, by virtue of its accumulated energy of motion, to overcome the penetrative resistance of the metal under test. This absorbs more or less of its striking energy, which is always constant. That which is not absorbed, as most notable in the harder metals, remains available for reacting on, or rebounding the hammer itself, and which is proportional to the hardness of any metal.

The hammer employed differs from the earlier models in that it is longer, heavier and drops and rebounds a comparatively shorter distance. The mechanism consists in the main of a sensitive one-way ball clutch and pilot sleeve, which normally holds the hammer at its upper starting position. When released, the pilot sleeve falls with the hammer, with the result that the slightest rebound, even though less than one thousandth part of an inch, is instantly fixed by the one-way clutch.

Following this cycle, the clutch assembly is raised up to its starting position, carrying the hammer with it in its now superposed position, due to the percentage of rebound recorded. Simultaneously, the hammer arriving at its upper or starting position, engages and actuates a rack and pinion and hair spring dial mechanism, which, in turn, faithfully indicates the amount of rebound of the hammer and, therefore, the hardness of the specimen. The hardness values shown by this instrument agrees faithfully with those shown on the vertical scale, or the older instrument, which is still popular and which the manufacturers shall list as heretofore, but which can be supplied at a somewhat lower cost.



SHORE MODEL D RECORDER

NEW METAL FINISH

After many years of experimentation, chemists have now developed a new finish for wood and metal, which it is claimed is so durable, tough and hard that it will resist high degrees of heat, hot or cold liquids and hot plates or dishes. It is described also as absolutely waterproof—in fact it can be washed with soap and water.

The new material which is known as viscolac is now in use in many wood and metal working industries including the manufacture of automobiles and furniture. It is made of ingredients entirely different from those of the old style varnishes. It is a pyroxylin solution, which is developed from cotton and which seems to have a natural affinity for wood and metal surfaces of all kinds.

It is said to have been tested out under some of the most difficult conditions, even live steam having been turned on it and yet it was found to survive this test. Chemists state that it does not readily chip or crack, is unusually hard and tough and has the extraordinary adantage from a manufacturing standpoint that it air-drys very rapidly.

The chemists who produce viscolac believe that it will completely revolutionize the art of wood and metal finishing. They point to the fact that tables and other household furniture finished with this new material are completely immune from any harmful effects of food or any kind of liquids being spilled on them, and that automobiles finished with the viscolac type of enamel retain their original beauty much longer than the ordinary finishes. Viscolac is made by E. I. Du Pont de Nemours & Company, Wilmington, Del.

NEW RESPIRATOR

The "Dustpruf" respirator has been placed on the market by the Pulmosan Safety Equipment Company, 45 West Houghby street, Brooklyn, N. Y. It is intended for use in dust, paint spray, light fumes and any other dangerous atmosphere. It is newly designed and, it is claimed, meets every need of industrial requirements. It has a "Dustpruf" filter; is said to be easy to clean; allows no leaks; allows clear, wide vision; has easily replaceable and changeable parts; holds its shape and fits the face well. The filter can be used wet or dry and is protected by a mesh. Straps are attached with snap fasteners, making replacement easy. Literature on use of this respirator will be sent on request.

"DUSTPRUF" RESPIRATOR

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN FOUNDRYMEN'S ASSOCIATION

Headquarters, 140 South Dearborn Street, Chicago, Ill.

The Committee on Molding Sand Research, under the guidance of the Division of Engineering of National Research Council and the American Foundrymen's Association, has made substantial progress during the past year.

At the annual convention of the American Foundrymen's Association held in May in Cleveland, a number of papers were presented by members of the committee at the sessions devoted to molding sands.*

The investigation was made possible through an appropriation to the American Foundrymen's Association, which was later supplemented by the National Research Council. Additional funds amounting to sum $15,000 are being sought to complete the program. Some of this has already been assured. In addition to the Foundrymen's Association and the Council, many firms, universities, governmental departments, societies and individuals are co-operating in the work.

The committee consists of 48 members, half of whom have been very active on several of its sub-committees. The personnel is of exceptional strength, including 10 metallurgists and physicists of high standing, 6 steel foundrymen, 6 malleable foundrymen, 6 grey iron foundrymen, 5 non-ferrous foundrymen, 5 geologists, 6 sand producers and 6 refractory and ceramic experts.

Three research assistants are now in the committee's exclusive employ—one at the Bureau of Standards, another at the Ohio Brass Company, and the third in the College of Engineering at Cornell University. In each case the research assistant has free and complete access to equipment owned by the respective institutions and the skillful guidance of an expert who is a member of the committee and who gives much of his time to the work without compensation of any kind.

The work accomplished to date has been mainly that of developing satisfactory methods of testing. At the beginning it was realized that a fundamental need existed for standard methods for comparison and selection of molding sands. These are now ready for publication, having been tentatively adopted by the committee and it is quite likely that they will be in universal use among the foundries within 12 months, especially three essential methods of tests to determine bonding strength or cohesiveness, fineness and permeability, as they are the only standard tests in existence. The other tests are chemical analysis, dye-absorption, and sampling of molding sands.

The importance of the work of this committee is emphasized by the fact that over $7,500,000 are expended annually for new molding sands—very little of which is re-used.

The Sub-committee on Geological Surveys has prepared for use of the State Geological Surveys, standard methods of making surveys of molding sand resources and preparing test samples. Some satisfactory deposits which have been worked for years are deteriorating, while others are being depleted. It is expected that new sources will be discovered through the impetus, given by the subcommittee.

The Subcommittee on Conservation and Reclamation has already brought about considerable savings in several foundries through the use of reclaimed molding sands. Methods of reclamation are being carefully studied as well as proper proportion of reclaimed and new sands.

Information is being exchanged with similar workers in Great Britain.

*See THE METAL INDUSTRY, May, 1923.

BRASS MANUFACTURERS ASSOCIATION

Headquarters Care of W. M. Webster, City Hall Square Bldg., Chicago, Ill.

The National Association of Brass Manufacturers held a most successful spring meeting at the Marlboro-Blenheim Hotel, Atlantic City, N. J., on June 12, 13 and 14, and a survey of the situation pertaining to the brass business in the plumbing line showed, of the entire membership, only two were making goods for stock, and that on an average the business on hand would operate the various plants practically eight (8) weeks, with good prospects for future business. Without exception, every member reported they were operating full force and full time, a number reporting that they were operating overtime and practically all operating on the open shop plan basis. A general impression prevailed that further demands for wages would not be made, though some did not share in those views. All reporting collections were very good, some stating they were excellent, and two (2) fair. As to the future of metal and copper markets, there was a divided opinion, for the vast majority thought that for the next ninety (90) days copper would remain stationary or where it is. Nine (9), however, expressed an opinion that copper would go to a higher market, while three (3) took the opposite view and looked for a lower market.

Stress was laid on the wonderful success attained in substituting the word "Faucet" and "Stop" for "Cock," as heretofore used, many stating that they even corrected salesmen's orders when they used the former name to that of "Faucets."

A Catalog Committee and an Attendance Committee were appointed, consisting of Messrs. R. L. Ottke, A. Mueller, C. M. Muend, Catalog Committee; Messrs. Karl Legner, A. Mueller, R. L. Ottke, Attendance Committee.

Reports from Committees on Standardization, Elimination, and Government Specifications were tendered showing splendid progress.

Notice was taken of the recent passing on of Andrew McDonald, of the A. Y. McDonald Manufacturing Company, Dubuque, Ia., and a committee was appointed to draw up suitable resolutions in respect to Mr. McDonald.

Messrs. Parks, Hills, and Purdue were appointed a committee to rejuvenate and revise the book gotten out many years ago by the association of "How to Figure Costs in the Brass Business."

Numerically, the association was never stronger and its finances better than the report Commissioner Webster submitted.

After three days of strenuous work, the meeting adjourned to meet in Cleveland, Ohio, on September 12 and 13.

AMERICAN ELECTROCHEMICAL SOCIETY

Headquarters, Columbia University, New York

We wish to inform you that the next meeting of the American Electrochemical Society will be held in Dayton, Ohio, September 27, 28 and 29, 1923. The plans for this meeting include:

A Symposium on Electrochemistry of Caseous Conduction, which is in charge of Dr. Duncan MacRae, Research Laboratories, Westinghouse Lamp Company, Bloomfield, N. J.

A Symposium on Recent Progress in Electrolytic Refining; chairman, F. R. Pyne, U. S. Metals Refining Company, Carteret, N. J.

An innovation at this meeting will consist of Round Table Discussions on the following four subjects:

Electric Furnace Brass Foundry Practice. Organic Electrochemistry. Chlorine. Electroplating.

Trips to local plants will also be made.

COPPER AND BRASS COUNCIL

Headquarters, Birmingham, Eng.

News was recently received of the formation in England of the Copper and Brass Extended Uses Council, with headquarters in Birmingham. The organizers are manufacturers of copper and brass sheet, tube, wire, etc. The announced purpose of the association is to collect facts and figures which can be used to educate the public regarding the advantages of copper and brass for various purposes for which at present other metals or materials are generally used. The first research is for the purpose of building up a body of supporting data concerning the superiority of brass and copper pipe for hot and cold water circulation.

The other work which this association has in hand includes the collecting of data with regard to the use of copper and brass in building construction. Information is also being compiled with regard to the lasting powers of copper leaders and gutters, compared with metals now used, to prove that copper for this purpose,

as well as copper and brass water service pipes, will be found to be less costly in the long run than the cheaper substitutes, when length of service is taken into account.

Other investigations in mind are the use of copper fire-back boilers instead of welded or cast-iron ones; copper cylinders, etc., for geysers, etc.; copper and brass tubes for steam boiler work instead of steel ones; and particularly the use of solid brass hardware instead of brassed iron goods that are largely being made there now, and the use of non-ferrous wire for wire goods, nails, etc.

Personals

GUILLIAM H. CLAMER

Guilliam H. Clamer, first vice-president of the Ajax Metal Company, of Philadelphia, Pa., and the new president of the American Foundrymen's Association, ranks among the foremost metallurgists in the non-ferrous industry. He was the first chemist to be regularly engaged in the brass foundry industry, as well as the first worker in the field of non-ferrous metallography in this country. He was born 48 years ago in Philadelphia. After graduating from the public schools of Philadelphia, Mr. Clamer worked in the private chemical laboratory of Dr. F. A. Genth. Later he entered the University of Pennsylvania from which he was graduated in 1897. Immediately upon graduation he became connected with the

GUILLIAM H. CLAMER

Ajax Metal Company in the capacity of chemist, advancing from this position so that now he is first vice-president and general manager of the company. He also is president of the Ajax Electrothermic Corporation. Mr. Clamer was presented the Elliott-Cresson gold medal, the highest award of the Franklin Institute in recognition of his work in the advancement of the art of foundry chemistry and metallography. He has been associated with Dr. Carl Hering, James Wyatt and Dr. Edwin P. Northrup in the development of electric furnaces. He has been active in promoting the welfare of the foundry industry and has for a long time been actively engaged in the affairs of scientific societies. He is, at the present time, chairman of several such committees. He is a past president of the American Society for Testing Materials, the American Institute of Metals and of the Committee on Science and Arts of the Franklin Institute. Mr. Clamer is the first of those engaged in the metal industries, outside of iron and steel to become president of the American Foundrymen's Association.

HOWARD EVANS

HOWARD EVANS

The Philadelphia Foundrymen's Association gave a dinner at the Manufacturers' Club, Philadelphia, Pa., Wednesday evening, June 13, in honor of **Howard Evans**, its secretary, as a testimonial to his long and faithful work as an officer of the organization. Mr. Evans was presented with a watch suitably inscribed. The speakers were William J. Johnson of the Baldwin Locomotive Works; Dr. E. J. Cattell of the Philadelphia Chamber of Commerce; Thomas Armstrong, vice-president of the Manufacturers' Club; J. H. Bougher, president J. W. Paxson Company, Philadelphia; George Pettinos and C. R. Spare of the American Manganese Bronze Manufacturing Company, Philadelphia. The Philadelphia Foundrymen's Association was organized in July, 1891, by Mr. Evans, and he has served as its secretary ever since. He organized the national association May 12, 1896, and was president from 1896 to 1900. Mr. Evans is vice-president and a director of the J. W. Paxson Company, foundry supplies, Philadelphia.

RUPERT G. BRUCE

Rupert G. Bruce, vice-president and general manager of the Canadian Hanson & Van Winkle Company, Limited, of 15 Morrow avenue, Toronto, Ontario, Canada, has recently been appointed vice-president of the Hanson & Van Winkle Company, of Newark, N. J. Prior to Mr. Bruce's connection with the Canadian company, he started in business for himself manufacturing electroplating and polishing supplies and equipment at Jarvis street, Toronto.

RUPERT G. BRUCE

Mr. Bruce first became connected with the Canadian Hanson & Van Winkle Company, Limited, in 1911 at the time the company was incorporated. Since that time he has been responsible for the rapid progress and development made by

the company by building up a very large business. His aggressiveness and effective business efficiency warrant the call he has received from the Hanson & Van Winkle Company of Newark, N. J. Mr. Bruce will, however, retain his former position with the Canadian company, as he is a large shareholder in the same.

E. W. **Lankenau** has been promoted from general foreman to superintendent of the General Electric Company plant at Decatur, Ind.

Charles A. **Smith,** 177 7th Avenue, New York, is in the business of putting up furnaces to reclaim old copper, brass or lead. He draws up the plans and has the furnaces put up, the exterior being of red brick and the interior of fire brick. This furnace burns soft coal and the cost to reclaim any kind of old metal is about one cent a pound.

A. W. **MacLaren,** of Chicago, has been elected president of the Oklahoma Belt Railroad Company, a belt line connecting with the Trunk Lines and Packingtown District at Oklahoma City, Okla. He was formerly general traffic manager of Morris and Company, and is now vice-president of the Chicago Bearing Metal Company, 507 McCormick Building, Chicago, Ill.

Among the passengers arriving on the S. S. Western World of the Munson S. S. Line in the Port of New York were Dr. and **Mrs. Louis D. Ricketts** of Warren, Ariz. Dr. Ricketts is former president of the American Institute of Mining and Metallurgical Engineers, and he is widely known as a consulting engineer. He and Mrs. Ricketts had just completed an extended tour through South America. **John D. Ryan,** of the Anaconda Copper Corporation, was also a passenger of the Munson liner.

Lieutenants **Gilbert C. Hoover** and **John H. Keefe,** of the United States Navy, were awarded degrees of Bachelor of Science in Metallurgical Engineering last June at Carnegie Institute of Technology, in Pittsburgh. These two naval officers were the first to complete a year of special study in metallurgical engineering since Carnegie Tech was selected by the U. S. Naval Academy about a year ago as the institution to which it proposes to send its graduates for specialized training in metallurgy.

F. M. Feiker, formerly vice-president of the McGraw-Hill Company, Inc., and more recently on leave of absence as Special Agent to the Department of Commerce at Washington, after his return from Washington will be associated with the staff of the Society for Electrical Development, 522 Fifth avenue, New York City. Mr. Feiker will retain a consulting relation to the McGraw-Hill Company, Inc., and he will continue in a similar capacity his relation to the problems of personnel and organization of the Department of Commerce at Washington.

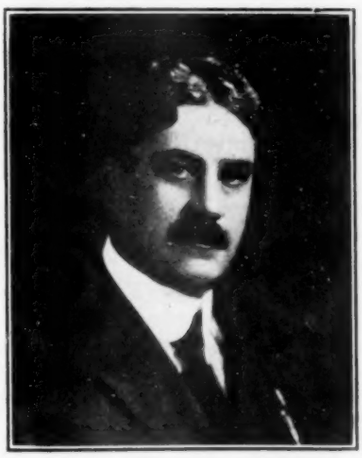
George H. Hawley has been appointed manager of the Metal Departments of the Standard Underground Cable Company's Perth Amboy, N. J. Works, to fill the vacancy caused by the death of C. C. Baldwin, which occurred on June 7th last. Mr. Hawley has been production manager for the past three years of the departments in question, which include the melting furnaces, rod, wire brass and tube mills, and those for the manufacture of weatherproof and magnet wire. He has had an unusually wide experience in such work and before going with the Standard Company was connected with the National Conduit & Cable Company at Hastings-on-the-Hudson, and for many years prior with the American Brass Company at Ansonia.

Four General Electric Company officials have just been given honorary degrees at four important American Universities recently. **Gerard Swope,** president of the company, was awarded the honorary degree of Doctor of Science at Rutgers College on June 12. **Owen D. Young,** chairman of the Board of Directors, was given the degree of Doctor of Literature at St. Lawrence University, of which he is an alumnus, on June 12, while **Dr. Irving Langmuir,** assistant director of the Research Laboratory, received the honorary degree of Doctor of Science from Union College. **David B. Rushmore,** consulting engineer, was given the D. S. degree from his alma mater, Swarthmore College. All of these men have been intensely interested in furthering scientific education in colleges and schools and have taken a leading part in the forward looking movement of co-operation between the colleges and industry.

Deaths

CHAUNCEY C. BALDWIN

Chauncey C. Baldwin for more than twenty years connected with the Standard Underground Cable Company at Perth Amboy, N. J., died at his residence there June 7, 1923, aged 57, after a brief illness. He had been one of the outstanding figures in the copper rolling and wire drawing industry for many years. Starting first with Wallace & Sons as superintendent, later building and operating the Waclark plant at Bayonne, N. J., and afterwards the rod and wire mills of The National Conduit and Cable Company at Yonkers. His connection with the Standard Underground Cable Company dates from 1902 as superintendent and manager of its metal departments at Perth Amboy, including its copper melting furnaces and equipment for the production of copper and brass rods and wire, tubes, weather proof and magnet wire products. In 1916 he was elected as vice-president of that company which position he held continuously to the time of his death.



CHAUNCEY C. BALDWIN

He took an active interest and part in local affairs and for some years past had been president of Perth Amboy Industrial Association. He was also a director of the First National Bank of Perth Amboy and other local interests.

CHARLES O. STANLEY

Charles O. Stanley, aged 91 years, one of the pioneer residents of Cincinnati, died at his home in that city May 1st. He was long connected with the non-ferrous foundry industry, his father having established a brass foundry in Cincinnati over 80 years ago.

FRANK CARL GLABAU

Frank Carl Glabau, 58, died at his home 96 Smalley Street, New Britain, Conn., following a lingering illness. He was employed as a brass molder at the Russell & Erwin Company foundry, New Britain.

ALEXANDER J. WATSON

Alexander J. Watson, for many years assistant secretary-treasurer of the International Nickel Company, 67 Wall Street, New York, recently died at his home in Plainfield, N. J., of heart disease in his 59th year. His wife and a married daughter survive.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

WATERBURY, CONN.

JULY 2, 1923.

For the first time in many months there has been a slight decrease rather than an increase in the number of men employed from month to month in seven of the largest industrial plants, according to figures furnished the Chamber of Commerce. One hundred and sixty-five less men are employed in the plants than during the previous month. The general belief is that the summer weather has taken this number of men into occupations which give them an opportunity to work outdoors, such as farm work and building construction. There has also been a slight falling off in orders of some of the factories during the past week. Industrial experts look on the decrease in the light of a blessing in disguise as there had been such a demand for goods of all kinds during previous months that business was not considered to be in a normal condition and there were signs of a new period of inflation.

Veto by **Governor C. A. Templeton** of this city of the drastic anti-pollution bill was hailed with satisfaction by the manufacturers as its passage previously by the legislature had been greeted with dismay. The bill was vetoed largely because of the representations made by the brass industries up and down the Naugatuck Valley that the bill would mean great injury to them if not disaster. A more moderate bill introduced earlier in the session which would have achieved the same result in time, namely the purification of the streams of the state of their pollution, met with favor from the manufacturers as its terms were so moderate that they could have been put in force without disturbing industry. The moderate bill also applied to city sewage equally with factory chemical wastes. While the bill finally passed discriminated in favor of the cities, and would apply only to factory chemical waste and not city sewage. This in spite of the fact that city sewage forms a much greater part of the pollution of the streams than does factory chemical wastes. That the attitude of the local manufacturers is for the elimination of pollution from streams so long as it is done so as not to injure the industries is seen from the fact that **John H. Goss,** general manager of the **Scovill Manufacturing Company,** is a member of the state commission which studied the matter and reported the moderate bill. In the meantime, the local factories are considering going ahead with their own plan, developed some years ago in co-operation with other factories along the valley, of eliminating the pollution of the Naugatuck river themselves. This idea is in brief, the construction of huge storage reservoirs in the upper branches of the river which in times of low water when the pollution is the worst, could be opened and the water flush out the pollution of the river.

Frederick A. Jackle, superintendent of the **Chase Metal Works,** one of the three branches of the Chase Companies, has been promoted to be practically general manager of all three plants, including the **Chase Rolling Mill Company** and **Waterbury Manufacturing Company**. His duties will principally be the coordination of several departments of all three plants, in order to cut down overhead expense, cost of operation, and to centralize departments making kindred products. There are machines in all three plants which produce similar goods. Some of the articles made in one or the other of the plants are often inferior in grade to those made by similar machines in other plants. Mr. Jackle will centralize all these machines making similar articles under the same plant. The electrical and other maintenance departments—now separate for each plant—will be also centralized. Superintendent Jackle will conduct the work of managing the Metal Works for about six hours a day as usual and will spend the other four hours in supervising the work of coordinating the departments of the different plants. While engaged in this work, **James Conlong** will manage the Metal Works.

Acquisition of the **American Brass Company** boosted the receipts of the **Anaconda Company** considerably, according to the latter's report just published. Its gross revenue for the past year was $173,450,384, the largest for any year in the history of the company. The previous year the gross revenue was $33,113,231. Chairman **John D. Ryan,** in his report, states that the most gratifying increase in the operations of the company has been the remarkable growth of the business of the American Brass Company which equalled 136,678,706 pounds for the first quarter of 1923, as against 45,925,470 pounds for the first quarter of 1921.

The foremen of the **Waterbury Buckle Company** motored to Momaugin June 9th for their annual outing and shore dinner. Fred Casey, Charles Duncan, Thomas Kelly, R. A. Moore and Earl Kinch entertained. Jess Palen, Robert Atwood, Frank Bagley and John Shea won the prizes offered in the sports events. W. Kavanaugh, G. Barth, R. Lavigne and W. Bronson managed the affair.

Henry Ames Crockett, 52 years of age of 65 Field street, for many years electrical foreman in the employ of the Chase Companies, Inc., was found dead in his home, June 5th. He was a member of Mount Olivet lodge of Masons of Washington, Me. He leaves a wife, one son, Harry G., and one daughter, Mrs. Conrad Pepper of this city. His funeral was held June 7th with burial in Pine Grove cemetery.—W. R. B.

BRIDGEPORT, CONN.

JULY 2, 1923.

It is understood that a settlement will be shortly agreed upon between the **United States Government** and the **Bridgeport Brass Company** in the matter of the alleged overpayment by the Government to the Brass Company on war time orders. An audit of the company's books by the Government agents has been in process for some time. The Government's allegation is that $700,000 was overpaid the company. The company questions the figures presented by the War Department and alleges that it was not overpaid and did not defraud the Government out of anything.

Factories of the **International Silver Company** in eight different cities sent nearly 300 executives to the annual outing of the firm held in this city last week, as guests of the local, Holmes & Edwards company. Barbour Silver company, Meriden; Derby Silver company, Derby; Meriden Britannia company of Meriden and of Florence, Mass.; Norwich Cutlery company of Norwich, William Rogers Manufacturing company of Meriden, Rogers & Brother of Waterbury, Simpson, Hall Miller company of Wallingford, Wilcox Silverplate company of Meriden, Watrous Manufacturing company of Wallingford, Silver City Cut Glass company and Wilcox & Evertsen, of Meriden, were the factories represented in addition to the local factory. George Wilcox, president of the company, was the guest of honor.

The second annual meeting of the Engineers club of Bridgeport was held last week. Some 250 members, some in yachts belonging to the members and others in autos went to the New Haven Yacht Club in Morris cove where field sports were held and an excellent dinner was served. **William R. Webster,** of the Bridgeport Brass Company, was one of the speakers at the dinner.—W. R. B.

TORRINGTON, CONN.

JULY 2, 1923.

A five per cent bonus for full attendance for 55 hours a week is being offered to employes by several Torrington manufacturers of metal products. The result has been greater production in practically all departments. The bonus is offered to both piece and hourly workers.

Torrington shops are working full time and half of them are working evenings as well. At least thirty per cent of the employes are affected by the overtime schedule.

A shortage of common labor continues here but there

appears to be sufficient skilled workers to fill other needs. The hourly rate for common labor is 40 cents.

Pay increases averaging close to ten per cent have been granted recently.

A larger number than ever before are engaged on a piecework basis. In fact, the representative of The Metal Industry is informed that fully three-fifths of the workers are on that basis now.

While transportation conditions are greatly improved, there is still room for some further improvement especially insofar as incoming shipments of steel are concerned.

Edwin H. **Waterbury,** 64, architect, designer of several of the factory buildings in Torrington, died June 15 in Stamford, where he had resided for the past several months.

F. P. **Weston,** former president of the Torrington Company, has sold his five-acre estate on Torrington's leading residential street to George H. Braman of the American Brass company. Mr. Weston has purchased a residence in Litchfield.

Work is progressing rapidly on the big addition to the plant of the **Union Hardware Company.** The Torrington Building company has the contract.

Robert **C. Swayze** of the Torrington Manufacturing company has purchased a residence in Litchfield.—J. H. T.

NEW BRITAIN, CONN.

JULY 2, 1923.

Business conditions thus far this summer maintain a high average among the metal manufacturing concerns of this city and vicinity, with stock issues and dividends reflecting a prosperous quarter just ending. These past few weeks indicate that the outlook for the next month or so will see no material lessening of business. The intense heat of the past month has materially retarded production and at the same time has held up sales to a certain extent except such manufactured articles as are seasonable. Sales departments report that jobbers are exercising no little caution in stocking up for future trade and retailers also are careful not to buy too heavily. There is not, however, anything to indicate a buying slump, it is reported.

Landers, **Frary & Clark,** at its quarterly meeting of directors a week ago, voted to recommend to the stockholders an increase in the capital stock from seven million to ten million and a half. This stock will be given free to stockholders on the basis of one for two, with no fractional shares. The dividend, which has been 12 per cent, has been cut to eight per cent on this issue. The **North & Judd Manufacturing Company** at its quarterly meeting declared a regular quarterly dividend of three per cent and the **Fafnir Bearing Company** gave theirs of two and one-half per cent. The **American Hardware Corporation's** regular dividend of three per cent was accompanied by an extra of an equal amount. A regular dividend of two and one-half per cent on common stock payable July 2 was declared at the **Stanley Works** and an extra of 5 per cent was also voted.

Business at the **New Britain Machine Company** plant, which has had a trying time since the war, is steadily picking up and hopes are high that the plant will eventually be brought back to a dividend paying basis. The **Stanley Works** business is excellent, a particularly heavy demand for butts being brought in by the automobile industry. This firm also has a good export trade. The **American Hardware Corporation,** while affected to some extent by the shut-down of building operations due to the high cost of labor and materials, still is executing enormous orders for builders' hardware of all kinds and big shipments are being made. Other concerns also are getting their share of business, making this summer a prosperous and successful one.—H. R. J.

ROCHESTER, N. Y.

JULY 2, 1923.

With the advent of the heated term, accompanied by its depressing effects, activities in a majority of the industrial plants about town have slackened to a remarkable degree. This is quite true among those manufacturing institutions employing metals. The vacation periods, annual closing for inventory, and the other summer handicaps are on hand in full force as usual.

Purchasing agents attached to the larger plants report that despite reports to the contrary business is better this summer than a year ago, and that orders for fall delivery are larger and prices are better, too. Much replenishment of stocks is in progress, last week's arrivals of sheet brass, copper, and aluminum being of unusual size. At this season of the year there is a good demand in Rochester for tin and zinc, and the local market for these materials is very firm.

Production is reported to be not so heavy at the **Eastman Kodak Company's** plants as is usual at this season of the year, although the film output is increasing. The total output of the **Bausch & Lomb** optical works thus far this year is said to have exceeded expectations and to have gone 15 per cent beyond January estimates.—G. B. E.

DETROIT, MICH.

JULY 2, 1923.

No material change has been reported in the brass, copper and aluminum business here for the past 30 days. Manufacturing in all lines is continuing strong, this being especially true in the production of automobile parts and accessories. Plumbing supply manufacturers report a good business with orders still ahead, although a decline is expected before long due to the seeming curtailment in building operations all over the country. Manufacturing jewelers also have been having a good run of business due, it is said, to general prosperous conditions.

Fire caused by an explosion in the enameling plant at the **Kelsey Wheel Company** last week caused an estimated loss of $50,000. Several firemen were burned in fighting the blaze, and many employes were forced to jump to safety, so rapidly did the flames spread throughout the building. Progress of the flames was helped when several barrels of turpentine became ignited, filling the building with dense smoke. More than forty men were working on the floor where the fire started and all had narrow escapes.

The **General Aluminum & Brass Manufacturing Company** has declared a quarterly dividend of 2 per cent on the preferred stock payable July 2, to stock of record of June 30.

The **Pemberthy Injector Company** also has declared a quarterly dividend of 2 per cent on perferred stock payable July 1, to stock of record of June 25.

The **Wolverine Specialty Company** has been organized at Battle Creek to manufacture automobile specialties. The officers are D. G. Wells, president; Charles J. Pearson, vice-president; A. P. Wells, secretary. H. H. Burns, John A. Mustard, H. L. Kneeland and L. J. Kuehnle, together with the officers, are the directors. Headquarters at 15 Carlyle street, Battle Creek, Mich.—F. J. H.

PITTSBURGH, PA.

JULY 2, 1923.

The metal industry in Pennsylvania is in a very healthy condition and the prospects for the Fall are equally bright. There is an increase of employment many factories finding difficulty in keeping their forces complete; wages have increased; sales are keeping up with the production and passing it in some instances and there has been almost a total absence of labor disputes or disturbances. No one reports poor business.

In Philadelphia the industrial employment showed a slight increase in May over the previous month. The average increase throughout that city in varied lines of industry was about 1 per cent.

Plumbing supply dealers say the sales have been steadily increasing. There is a good demand for nickel water fixtures and sanitary pottery.

C. R. Spare, president of the **American Manganese Bronze Co.,** of Philadelphia, presented an illustrated address on "Bronze and Brasses for Engineering and Commercial Purposes," before the Philadelphia Foundrymen's Association, June 14th, at the Manufacturers' Club.—H. W. R.

TRENTON, N. J.

JULY 2, 1923.

The shortage of common labor in Trenton is one of the signs that business continues good here. State Commissioner of Labor Lewis T. Bryant says there is a shortage of certain types of workers. Practically all types of industry are exceedingly busy and opportunities await anyone willing to accept available positions at a reasonable wage. New Jersey in 1919 had 2,687 manufacturing establishments, each with a value of product in excess of $100,000.

The **Skillman Hardware Manufacturing Company** is now occupying its new addition on Edgewood avenue, Trenton, which was erected to take care of increased business.

Raymond S. Burbank has established an establishment for acetylene welding at 605 Princeton avenue, Trenton, N. J.

The **Trenton Welding Company,** 219 East Front street, Trenton, has installed additional mechanical equipment and is very busy.

Thomas S. Shegog, who some time ago invented a process for the removal of zinc oxide from scrap metal, has returned from a lengthy trip to California.

Contracts were recently signed by which the **John A. Roebling's Sons Company** will be furnished with 4,000 KVA auxiliary service by the Public Service Electric Company. The current will be used at the big Trenton plant. This is the famous bridge building concern which manufactures wire products of all kinds and has heretofore operated its own electric generating plants. Service furnished will be fed from the Trenton sub-station and the sub-station to transform and distribute 440 volt, three-phase power, is now being erected.

Elizabeth Auto Parts Manufacturing Company, of 707 Livingston street, Elizabeth, N. J., has been incorporated at Trenton with $10,000 capital and will purchase the letter patents granted to E. L. Conard for the improvement of transmission lines for automobiles. The incorporators are Eugene L. Conard, 126 Miller street, Elizabeth; Louis L. Belzky, Jr., 717 Livingston street, Elizabeth, and Emil H. Votter, 778 Newark avenue, Elizabeth.

Lebonray Corporation, of Newark, to manufacture chemicals, has been incorporated at Trenton with $25,000 capital. Thomas G. Thompson, of New York, and Francis P. Finck and Mary C. Hely, both of Newark, are the incorporators.—C. A. L.

PROVIDENCE, R. I.

JULY 2, 1923.

Two large conventions to be held in this city—the American Electro-Platers' Society, July 2 to 5 and the American National Retail Jewelers' Association, August 28—are affording ample scope for all the spare time there is to give outside of actual business affairs. So far this year all lines of metal trades have experienced nearly a normal business condition. There was a gradual increase until the early part of last month when there was the usual slacking off and the indications are that July will be somewhat dull.

The beginning of July finds many of the manufacturing plants planning for the annual shut down for overhauling and repairs and for the vacation periods. Some of the plants will close the first week or fortnight of July while others will be closed at various times during this month and the early part of August.

The **Biltmore Novelty Company** has obtained a charter under the laws of Rhode Island to manufacture, deal and sell jewelry, jewelry novelties and celluloid products in this city. The concern is capitalized at $10,000 and the incorporators are Maurice Robinson, Charles M. Robinson and David C. Adelman.

The **Fairfield Plating Company,** 19 Calender street, is being conducted by John H. McGee of 24 Read street, Riverside, and Frank P. Murray of this city, according to their statement filed at the office of the city clerk.

The **M. J. Brohan Company** has been incorporated under the laws of Rhode Island with a capital of $50,000 with Joseph N. Brohan, Susan Brohan and Charles J. Rancourt all of North Attleboro, as incorporators. The concern is engaged in the manufacture of jewelers' and silversmiths' tools in the Bliss building, on Chestnut street, in North Attleboro.

Otis Brothers Company, refiners, who have been located in the Fitzgerald building, 187 Eddy street, for the past 36 years, have recently purchased the building at 76 Clifford street and also the refining plant of **John Austin** & Son, refiners, who are at present in bankruptcy, which for several years was located therein. The new owners have removed their office from Eddy street to the Austin plant and will remodel the rear of this property for rental for manufacturing jewelry purposes. They will retain their own well-equipped refining plant at 100 Blackstone street.

Cook-Dunbar-Smith Company, manufacturers of plate and wire at 85 Sprague street, recently purchased the property for many years occupied by the **W. J. Feeley Company,** on South Angell street with the intention of removing thereto, have decided to remain at their old plant and have accordingly sold the South Angell street property to the **American Emery Wheel Works,** whose plant adjoins it.

Thomas H. O'Brien, of **Carpenter & Wood, Inc.,** has purchased and taken over the business of Higgins & Metcalfe, electro-platers, 101 Sabin street, and will continue the business under the firm name of Thos. H. O'Brien Co. with Frederick T. Higgins, formerly of Higgins & Metcalfe, as general manager. The plant will be completely renovated and considerable new plating apparatus installed.—W. H. M.

OAKLAND, CAL.

JULY 2, 1923.

In a survey of the non-ferrous metal trades of California, San Francisco is well at the head of the list with almost forty concerns actively engaged in conducting shops doing work for the trade besides the larger plants that have departments doing their exclusive work. The plants engaged in the trades are well equipped and the work produced is recognized as excellent.

Some of the larger plants of San Francisco are in this list: Western Brass Manufacturing Company, 217 Tehama street; Standard Plating Works, 288 First street; M and H Plating Works, 717 Market street; Sunset Plating Works, 360 Clementina street; Cal. Tin Plating Works, 1705 Mission street; Capitol Plating Works, 1115 Gary street; Golden Gate Plating Works, 131 Mission street; San Francisco Plating Works, 1349 Mission street.

Business in the many shops is at the peak and bids to continue through the Summer. One reason advanced for the continued good trade is the automobile industry. There are now six automobile factories operating here besides the two hundred garages and retail stores that deal in accessories and have agencies directly in touch with the car industry.

At the shops of the **Progressive Plating and Enameling Company,** 857 27th street, it was learned that the agency for the Udylite process had been secured for the Pacific Coast and that this agency had resulted in a rush of work that indicated a continued run for the future to justify an enlargment of the plant. **R. C. Cavallera** stated that he has one contract alone that promised to call for the full space of his present plant, that of doing the entire enameling for the Durant cars which included the plating of special parts.

Other shops of the city have similar contracts with the Chevrolet, Star, Fageol, Doble Steam Car, Best Tractor and several engine companies operating extremely large plants.

The **California Brass Works** has come into the local field and are operating under the direction of O. L. Krenz and W. A. Noble at 1732 Francisco street, Berkeley.

L. G. Delamothe, of the **Oakland Plating Works** at 517 18th street, has lately built many improvements to care for his trade. One of his jobs has been the finishing of the metal doors and panels of the new Pacific Gas and Electric Building. One of the specials upon which he received much trade was the metallizing of baby shoes.

The **Western Metalcraft Company** has been organized at 215 American Bank Building in Los Angeles with a capitalization of $10,000 to engage in the metal finishing business under the direction of David C. King.

The **Union Metal Products Company** is being organized in 320 Dalzel Building, Oakland, by S. J. Taylor.

The **Neidringhaus Metalware Company,** of St. Louis, has entered the Oakland industrial zone, purchased property at 97th avenue and the Railroad, and are erecting suitable buildings to engage in the production of barrels and similar metal products. They will add a metal finishing department.

The **Price-Pfister Brass Manufacturing Company** is a new Los Angeles concern located in 725 Stock Exchange Building under the direction of Arnold Praeger.

The Boyle **Manufacturing Company,** one of the large firms of Southern California, has also come to Oakland and purchased a home at Park and Blanding streets in Alameda where they will manufacture many specialties that will require much nickeling and finishing.

The **Stewart Manufacturing Company,** of 4073 Hollis street, in Emeryville, has greatly increased their manufacturing output since removal to the new address as given. Their new plant is to have a metal finishing department added before the end of the year, according to J. A. Stewart the manager.—J. W. M.

MONTREAL, CANADA

JUNE 1, 1923.

Manufacturers in all lines of brass, copper and aluminum report a continued increase in business. Manufacturers of plumbing brass goods are experiencing a heavy demand for their products. The manufacturing jewelry shops are now fully employed. Warnings against inflation throughout the business community in the last few months are being heeded, it being pointed out that in many respects there is sound reason for business men to use an element of caution in their transactions.

The situation so far as Canada is concerned seems to be well in hand. Business men on this side of the line seem to have realized from the earliest period of the movement that the greatest danger to be feared was over-anxiety to advance prices in conjunction with similar action in United States markets. Overzealousness in salesmen and in sales endeavor by manufacturers and jobbers has been another feature against which Canadian business heads have issued a warning. Inducing dealers to buy simply on that assumption that the market is going to advance and without any regard for the dealer's ability to turn over the stock purchased is deplored.—P. W. B.

The **Fan Flame Spark Plug Company,** of Canada, Ltd., has been organized with a capital of $250,000, and main offices in Montreal.

Frankel Brothers, Ltd., have incorporated with a capital of $1,000,000. The company will include their houses in Toronto and Montreal.

BIRMINGHAM, ENGLAND

JUNE 19, 1923.

Improvement in the conditions of the non-ferrous industries is continued, but progress since Whitsuntide has been slower than was expected. The brass trade is now again brightening up. Copper and spelter having became cheaper, manufacturers have been able to quote prices which give them a better chance in competition for overseas trade. German competition at home, as the result of the Ruhr difficulty has also become less troublesome. Demand for builders' brassfoundry is steadily increasing both at home and abroad. Home demand for electrical fittings is growing as the result of the reductions in the charges for current. Export enquiries for all kinds of brassfoundry and especially for gas, steam and water fittings are on the increase especially from Australia and New Zealand. The Indian market has also re-opened and a number of orders for cabinet brassfoundry have been received. In most departments, however, orders are of small bulk. Shipbuilding, owing to the dispute with the boilermakers, is slow in reviving, but firms in this district have been getting a few orders for fittings and decorative work for new passenger liners. In general stamped and pressed metal work the cheaper lines are those in greatest demand. The automobile trade has been fairly flourishing this year and has provided a great deal of work for the aluminium foundries and makers of brass and other metal fittings. The fillip to lamp trade has been assisted by the revival of the pedal-cycle industry, which has this year had its best season since the war. Political conditions have retarded the removal of trade in bedsteads with the Near East, but a slight improvement in other markets is reported. Attempts to combat by new designs and advertising propaganda the home preference for wooden bedsteads have not proved particularly successful. Brass is being increasingly employed in bedstead manufacture and the tube-makers are laying themselves out to produce more square-section material to meet the requirements of the new tendency in design. Silversmiths and electro-platers are still poorly employed, but a few good orders have come to hand lately for spoons and forks for home and export, Canada having lately taken the largest consignments. A few firms are doing pretty good business with Australia in the new nickel as well as in electroplate. The Birmingham jewellery trade shows little improvement, the briskest movement being in the cheaper lines. Rollers of aluminium sheet are finding a good demand, the material being now used for many purposes in place of stamped brass. Wire is in diminishing demand. The listening-in craze has slackened with the advance of summer and the various requirements in this respect are largely met by imported material.—G.

Business Items—Verified

The **Hardinge Company,** 120 Broadway, New York, reports the sale of six grinding mills.

The **Oden Corporation,** manufacturers of buffs, have moved to College Point, L. I. City, N. Y.

The **Manning Abrasive Company, Inc.,** Troy, N. Y., is erecting an addition to their plant at Watervliet, N. Y.

V. Henning & Son, 330 Belmont Avenue, Brooklyn, N. Y., have changed their name to the Belmont Smelting & Refining Works, Inc.

The **Durex Chemical Corporation** announces the removal of its offices from 110 East 42d street to 160 Front street, New York City.

Jacob **Van Deree,** a well known Paterson, N. J. plater has opened a shop at 820 Main Avenue, Passaic, for job work in nickel, silver, brass and copper plating.

Benj. **Dobrin** has taken over the shop of the New York Electro Plating Company at 31 West 125th Street, New York City. He specializes in hotel and restaurant work.

Economy Foundry Company, 312 Adams street, Newark, N. J., manufacturers of castings of aluminum, brass, composition, bronze and bearing metal, aluminum match plates.

On and after July 1, 1923, the **Irvington Plating Company** will be located on the ground floor at 579 South Grove street, Irvington, N. J.

The Roller-Smith Company, 233 Broadway, New York, announces the appointment of H. D. Baker, 525 Woodward avenue, Detroit, Mich., as its representative in the State of Michigan.

The California Foundries, Inc., Oakland, Calif., have rebuilt their plant on 19th Avenue between East 12th and Livingston streets, which was destroyed by fire last July, and are now running full-handed.

Franklin Brass Foundry Company, Reading, Pa., are erecting a new building 50x 65, one-story and basement at a cost of $15,000. They are also making repairs to their plant on Pear street between Bern and Richmond.

The Pennsylvania Crusher Company has recently removed its offices from the Peoples Bank Building to the Oliver Building, Pittsburgh, Pa., under the management of H. M. Hallett, as district manager.

The Roessler & Hasslacher Chemical Company, 709 6th avenue, New York, with plant at Perth Amboy, N. J., has presented a claim of $708,864.02 against the German Government for damages sustained during the war.

H. C. Baum & Company, Plainville, Conn., have sold their factory at Railroad Square, and have erected another one, into which they have since moved. This concern operates the following departments: plating, tinning, polishing, lacquering,

The Worcester Japanning & Enameling Company, Worcester, Mass., has been organized to do japanning and enameling. Negotiations have been made for present manufacturing. This concern operates the following departments: japanning, lacquering.

The Gilby Wire Company, 108 Adams street, Newark, N. J., has just installed equipment for rolling flat wire in phosphor bronze, nickel, silver, brass, copper, aluminum, Monel, pure nickel and common bronze. They are specializing on narrow sizes in thin gauges.

The Michigan Copper & Brass Company, 5831 West Jefferson street, Detroit, Mich., has commissioned Lane, Davenport & Peterson, Charlevoix Building, architects, to prepare plans for a two-story addition, 48 x 125 ft. to cost $30,000. This concern operates the following departments: tool room, casting shop, brazing, rolling mill.

The Copper Export Association, which was organized in 1921 to handle exports of copper metal for local producers, has sold all of the 400,000,000 pounds of metal marked for export at that time. The copper was pledged by producers at 10 cents a pound and $40,000,000 of notes were issued by the association with the copper as collateral.

The Greenduck Metal Stamping Company, manufacturer of metal advertising novelties, 2127 Tilden avenue, Chicago, Ill., has purchased the J. L. Lynch Company, manufacturer of advertising buttons, Chicago. This concern operates the following departments: brass machine shop, tool room, grinding room, casting shop, cutting-up shop, spinning, plating, japanning, stamping, soldering, polishing, lacquering.

James H. Rhodes & Company, Chicago, Ill., are about to complete an extensive building located on the Degnon Terminal near Hunters Point avenue, Long Island City, N. Y. This company will grind nearly 500 tons of pumice per month, all of which is imported from Italy. Their office will also be located in this same building. They expect to move the New York office, now located at 117 Fulton street, about August 1st.

The Hopewell Products Company, Hopewell, N. J., recently organized with a capital of $100,000, has secured property on Burton avenue for a new plant for the manufacture of metal and wooden mechanical toys. Equipment will be installed at an early date. Theodore A. Pierson, Jr., is president and general manager. This concern operates the following departments: plating, japanning, stamping, soldering, lacquering.

The **New Jersey Zinc Company** has declared an extra dividend of 2 per cent in addition to its regular quarterly dividend of 2 per cent.

The new shop of the **No Dust Drying Machine Company,** at Globe and Hospital streets, Providence, R. I., is larger and better suited to that company's needs. They state that better deliveries will be made than was possible in the old shop.

The St. Louis Brass Manufacturing Company, St. Louis, Mo., has changed its name to the Edwin F. Guth Company and has filed application to increase its capital stock from $50,000 to $500,000. Edwin F. Guth is president. This concern operates the following departments: brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, spinning, brazing, plating, stamping, soldering, polishing, lacquering.

The New Jersey Valve & Fitting Company, Inc., Second avenue and Susquehanna Railroad, Hawthorne, N. J., recently incorporated, has been operating for the past six months in the manufacture of copper, brass and aluminum valves, cocks, fittings and specialties. It has its own brass foundry and finishing shop and is in a position to furnish these products and also rough castings. This concern operates the following departments: brass, bronze and aluminum foundry, brass machine shop, tool room, grinding room, polishing, lacquering.

United Smelting & Aluminum Company, Inc., New Haven, Conn., has made arrangements with M. J. Schultze of the Superior Steel Products Company, 38 Pickering Building, Cincinnati, Ohio, to represent them in Cincinnati and surrounding territory. The United Smelting and Aluminum Company, Inc., manufacture aluminum sheets, coils and circles, pure aluminum ingots and alloys, also babbitt metals and solders and it has just completed a new plant at Hamden, Conn., for the manufacture of all grades of brass and bronze ingots.

The Copper & Brass Research Association, 25 Broadway, New York, has just added to its membership the Engels Copper Mining Company, Gransby Consolidated Mining, Smelting & Power Company, Dallas Brass & Copper Company, Merchants & Evans Company, T. E. Conklin Brass & Copper Company, J. M. & L. A. Osborn Company, and Richards & Company, Ltd., the present membership of the Association being comprised of 26 copper mining companies and 15 copper and brass fabricating and distributing companies.

The Gibb Instrument Company, Bay City, Mich., manufacturer of electric welding equipment, has been appointed distributor of the General Electric Company's arc welding electrodes in the Middle West.

The plant of the **Electric Furnace Company,** Salem, Ohio, manufacturer of electric heating and melting furnaces, has been purchased by R. F. Benzinger and F. A. Hoyles, Alliance, and F. T. Cope, Salem. The business will be under the management of Mr. Cope, who had long been connected with the old company. Mr. Benzinger will have charge of the sales department. This concern operates the following departments: brass machine shop, tool room, brazing, soldering.

INCORPORATIONS

Capitalized at $1,500 the **Atlas Bronze Manufacturing Company,** 412 Orleans avenue, Chicago, Ill., recently was incorporated by Louis E. Price, James Price and Charles C. Brecht. The company is represented by Emanuel M. Schwartz, 1001 Conway Building. This concern operates the following departments: brass and bronze foundry.

The Monark Metal & Supply Company, 5121 North Second street, St. Louis, Mo., recently incorporated under the laws of Missouri with a capital stock of $50,000, are wholesale buyers and sellers of all grades of scrap metals. Their properties cover an area of 150 x 165 feet, and they have recently completed an addition to their buildings which will increase floor space to 50,000 square feet.

The Wireless Resistor Company, Milwaukee, Wis., has been organized by Arnold Pfau, 3011 McKinley Boulevard, consulting engineer of the Allis-Chalmers Manufacturing Company, to engage in the manufacture of a new metal alloy under exclusive American rights to Swiss patents. J. Rohn and Arthur Voss are associated with Mr. Pfau. The alloy is claimed to be more efficient than any other composition yet devised for use as heating elements in electrical appliances and devices. A factory has been equipped in one of the buildings of the former Pabst Brewing Company group.

The Connecticut Blower Corporation, Hartford, Conn., has been incorporated under the laws of Delaware with capital of $250,000—M. E. Keeney, president, C. H. Keeney, treasurer, C. E. Keeney, secretary. They have taken over the International Blower Company and the Hartford Sheet Metal Works. The products manufactured and installed are blowers and exhaust fans, blower systems of all kinds, dust collecting systems, exhaust systems, ventilating systems, etc. The plant of the International Blower Company will be utilized until Fall, at which time a considerably larger plant will be occupied.

The Niagara Falls Smelting & Refining Corporation, Niagara and Albany streets, Buffalo, N. Y., has been organized. The new company is manufacturing special alloys and standard ingots, metals and composition. **Ernest G. Jarvis,** to whom the readers of THE METAL INDUSTRY need no introduction, is the vice-president and general manager. He was until the end of 1922, superintendent of foundries and rolling mills for the McNab & Harlin Manufacturing Company and its subsidiary, the Aterite Company. He is one of the Board of Governors of the New Jersey Chemical Society and was formerly associated with the Steel Company of Canada, Harvester Corporation, Metals Coating Company of Canada, Canadian Westinghouse Company. Among the directors is also found F. A. J. Fitzgerald of the Fitzgerald Laboratories of Niagara Falls, a well known authority on electric furnaces and one of the officers of the American Electrochemical Society. W. R. Hopkins, attorney at law, Cleveland, is the president, Arthur Maddigan of the Hygrade Fuel & Oil Corporation, Buffalo, N. Y., is the treasurer and Howard O.

Babcock, manager of the Frontier Finance Corporation, Niagara Falls, N. Y., is the secretary. They are still adding additional melting and handling equipment.

BUSINESS TROUBLES

The Security Trust Company, Detroit, Mich., has been appointed receiver for Stroh Castings Company, and is conducting the business of the company to some extent in the manufacture of aluminum household utensils, and gray iron castings. This concern operates the following departments: aluminum foundry, polishing.

ANACONDA MAY BUY CABLE COMPANY

The Anaconda Copper Company is expected to acquire the properties of the National Conduit and Cable Company within the near future. The latter company is now in the hands of the court and a committee of stockholders and bondholders was organized some time ago for the purpose of endeavoring to rehabilitate or refinance the property. Thus far these efforts have not met with success. The committee recently received an offer of $700 for each $1,000 bond of an issue of $4,168,500 of the 6 per cent bonds outstanding, and it was learned that the Anaconda organization had made the bid.

The National Conduit and Cable Company has a large copper wire and rod plant at Hastings-on-Hudson, as well as a department which specializes in the manufacture of brass products. The rod and wire mill will help to round out the plans which the officials of the Anaconda Company have had in mind for some years and which began to materialize with the acquisition of the American Brass Company in the early months of 1922 and the Chile Copper Company early this year. The properties which Anaconda contemplates taking over are expected to be reorganized and production placed on a parity with other plants now operated by the company.

The Stockholders' Protective Committee recently increased its efforts to save the organization for the benefit of the interest which it represents. Shortly after the offer of $700 per bond had been made the stockholders requested the bondholders to join with them in efforts to save the properties so that the bondholders might get a hundred cents on the dollar for their interest and the stockholders conserve their property. Since then the greater part of the bonds have been deposited with the National City Bank, which is depositary for the Bondholders' Committee. Unless the stockholders can muster together sufficient funds to outbid the Anaconda at a public sale, the latter is expected to take over the properties.—New York Times.

Brass, Bronze, Copper and Allied Products

Abstracted from Department of Commerce Statistics

TABLE 1.—SUMMARY FOR THE UNITED STATES: 1869 TO 1921

Census Year.	Number of establishments.	Wage earners (average number).	Primary horsepower.	Capital.	Wages.	Cost of materials.	Value of products.	Value added by manufacture.[1]
				Expressed in thousands				
1921[2]	911	39,830	([3])	([3])	$46,260	$130,627	$214,904	$84,277
1919	1,092	75,051	265,688	$325,300	94,132	304,824	482,313	177,489
1914	992	40,306	122,700	116,093	25,084	115,487	162,199	46,712
1909	1,021	40,618	106,120	109,319	23,677	99,228	149,989	50,761
1904	813	33,168	69,494	77,438	17,666	65,653	102,407	36,754
1899	695	27,166	47,257	51,120	13,599	61,189	88,654	27,465
1889	610	[4] 21,849	27,571	39,490	[5] 11,293	27,293	50,056	22,763
1879	449	[4] 12,614	([3])	15,579	[5] 5,729	16,864	27,332	10,468
1869	335	[4] 5,156	5,442	8,941	[5] 2,707	7,093	13,131	6,038

[1] Value of products less cost of materials.
[2] Figures for 1921 do not include data for establishments reporting products valued at less than $5,000. (See footnote 2, Table 2.)
[3] No data.
[4] Not strictly comparable with 1899 and subsequent years.
[5] Includes salaries.

TABLE 2.—GENERAL STATISTICS FOR ESTABLISHMENTS, GROUPED ACCORDING TO KIND OF METAL OR ALLOY USED, FOR THE UNITED STATES: 1921

	Total for the industry.	Establishments Manufacturing Principally— Brass and bronze products.	Copper products.	Other metal products.[1]
Number of establishments	911	881	21	9
Persons engaged	46,712	43,862	2,407	443
Proprietors and firm members	582	563	14	5
Salaried employees	6,300	5,949	230	121
Wage earners (average number)	39,830	37,350	2,163	317
Salaries and wages	$62,553,238	$58,390,814	$3,315,691	$846,733
Salaries	16,292,935	15,360,391	671,176	261,368
Wages	46,260,303	43,030,423	2,644,515	585,365
Paid for contract work	318,336	314,994	.....	3,342
Cost of materials	130,627,160	113,804,801	15,151,441	1,670,918
Value of products[2]	214,903,735	192,660,404	19,907,172	2,336,159
Value added by manufacture[3]	84,276,575	78,855,603	4,755,731	665,241

[1] Chiefly establishments manufacturing white metal die castings; Monel castings; zinc plates, sheets, and strips; and German-silver and other products.
[2] In addition, brass, bronze, and copper products, valued at $52,476,473, were manufactured by establishments engaged primarily in other industries in 1921. These additional products were distributed as follows: Brass and bronze, $10,195,739; copper, $42,272,863; other metal, $7,871.
[3] Value of products less cost of materials.

TABLE 4.—RELATIVE IMPORTANCE OF LEADING STATES: 1921

State	Number of establishments	Value of Products			Value Added by Manufacture			Wage Earners		
		Amount	Per cent distribution	Rank.[1]	Amount	Per cent distribution	Rank.[1]	Average number	Per cent distribution	Rank.[1]
United States....	911	$214,903,735	100.0	..	$84,276,575	100.0	..	39,830	100.0	..
Connecticut	59	65,795,194	30.6	1	25,453,765	30.2	1	15,373	38.6	1
New York	158	32,759,231	15.2	2	15,439,663	18.3	2	6,490	16.3	2
Michigan	71	26,021,626	12.1	3	11,324,415	13.4	3	4,290	10.8	3
Pennsylvania	107	18,554,016	8.6	4	5,367,000	6.4	5	2,267	5.7	5
Ohio	79	15,494,034	7.2	5	6,362,719	7.6	4	2,539	6.4	4
Illinois	81	11,361,372	5.3	6	3,890,702	4.6	6	1,677	4.2	6
Massachusetts	64	6,807,799	3.2	7	2,789,907	3.3	8	1,539	3.9	7
New Jersey	62	6,473,870	3.0	8	2,858,792	3.4	7	1,257	3.2	8
Wisconsin	28	6,340,751	3.0	9	1,978,526	2.3	9	976	2.4	9
Missouri	18	4,049,396	1.9	11	1,473,857	1.7	11	464	1.2	13
Indiana	25	3,298,653	1.5	12	1,704,519	2.0	10	780	2.0	10
California	46	3,029,346	1.4	13	1,287,822	1.5	12	467	1.2	12
Maryland	17	2,229,772	1.0	14	766,901	0.9	13	499	1.2	11
Washington	11	894,653	0.4	15	432,967	0.5	15	105	0.3	17
Texas	6	827,618	0.4	16	271,904	0.3	18	91	0.2	18
Minnesota	9	746,829	0.3	18	409,120	0.5	16	171	0.4	14
Rhode Island	12	586,690	0.3	19	402,755	0.5	17	110	0.3	16
All other States[2]...	58	9,632,885	4.5	..	2,061,241	2.5	..	735	1.8	..

[1] The statistics for the States which rank tenth and seventeenth in value of products and for the State which ranks fourteenth in value added by manufacture and fifteenth in number of wage earners can not be shown without the possibility of disclosing the operations of individual establishments.

[2] Alabama, 3 establishments; Colorado, 8; Delaware, 4; District of Columbia, 2; Florida, 1; Georgia, 1; Iowa, 5; Kansas, 2; Kentucky, 6; Louisiana, 4; Maine, 2; Montana, 1; Nebraska, 2; New Hampshire, 5; Oregon, 3; Tennessee, 1; Utah, 1; Vermont, 2; Virginia, 2; and West Virginia, 3.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America.....	$100	$465	$510
American Hardware Corporation.....	100	53	57
Anaconda Copper	50	46	46⅛
Bristol Brass	25	11	13
International Nickel, com.....	25	11½	11⅞
International Nickel, pfd.....	100	78	83
International Silver, com.....	100	55	70
International Silver, pfd.....	100	106	110
National Conduit & Cable.....	100	¼	½
National Enameling & Stamping.....	100	56½	57
National Lead Company, com.....	100	109	111½
National Lead Company, pfd.....	100	110	112
New Jersey Zinc	100	148	152
Rome Brass & Copper.....	100	115	125
Scovill Manufacturing Company, new....	...	160	170
Yale & Towne Manufacturing Co., new..	...	60	63

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TRADE PUBLICATIONS

Mellon Institute of Industrial Research.—Tenth annual report, issued by University of Pittsburgh, Pittsburgh, Pa.

The John Crerar Library.—Twenty-eighth annual report for the year 1922, printed by order of the Board of Directors, Chicago, Ill.

Lead Wool.—A folder issued by the Hoyt Metal Company, St. Louis, Mo., on their lead wool used for caulking gas and water pipes, etc.

Tinware Coatings.—Bulletin 9 issued by Hilo Varnish Corporation, Marcy and Flushing avenues, Brooklyn, N. Y., describing their tinware coatings.

Trolleys.—A folder issued by the Yale & Towne Manufacturing Company, Stamford, Conn., covering the new Yale trolleys. This folder is illustrated.

Year Book of the American Bureau of Metal Statistics.—Third Annual Issue, 1922, issued by American Bureau of Metal Statistics, 115 Broadway, New York.

Tool and Cutter Grinding.—An attractively bound handbook on tool grinding, issued by the Norton Company, Worcester, Mass. This handbook includes a catalog of Norton universal tool and cutter grinding machines.

Acheson Electrodes.—A folder issued by the Acheson Graphite Company, Niagara Falls, N. Y., covering their electrodes for electric furnace requirements.

Washing Machines.—A folder issued by Crescent Washing Machine Company, Beechwood avenue, New Rochelle, N. Y., on their new Crescent metal-cleaning machines.

The Apollogram.—Vol. 1, No. 1. A house organ, published every little while by the Apollo Metal Works, La Salle, Ill., in the interests of the hardware and sheet metal trades.

The Engineering Foundation.—Report for the year ended February 8, 1923—eighth year. Publication No. 6, issued by Engineering Foundation, Engineering Societies Building, New York.

"Zero."—A booklet issued by the Graver Corporation, East Chicago, Ind., illustrating and describing the Graver hot process water softener—equipment adapted for treating boiler feed water.

"Airway Equipment."—Bulletin No. 12, issued by Binks Spray Equipment Company, 3114-26 Carroll avenue, Chicago, Ill., illustrating and describing "Airway" spray equipment for industrial painting.

Luco.—A folder issued by Thomas F. Lukens Metal Company, 1105 Fairmont avenue, Philadelphia, Pa., on their liquid flux, a soldering fluid for tinware, can, galvanized iron, brass, copper, sheet metal, etc.

The Pot.—Vol. 1, No. 1. A house organ, published spasmodically by the Zeller Lacquer Manufacturing Company, 342 Madison avenue, New York. Lacquer users will find it extremely interesting and amusing.

"Pennsylvania" Hammer Crushers.—Bulletin 1005, issued by Pennsylvania Crusher Company, Stephen Girard Building, Philadelphia, illustrating and describing the complete line of heavy duty "Pennsylvania" steel built hammer mills.

Stop-Off Varnish.—A folder issued by Baker & Company, Inc., Newark, N. J., on stopping off varnish for platinum plating, made for use with Baker platinum plating solution. The folder gives directions for application, thinning and removing.

Ross-Tacony Crucibles.—A catalog issued by the Ross-

Tacony Crucible Company, Tacony, Philadelphia, Pa., on their crucibles. This catalog shows the recently adopted American Standard sizes, which they are now prepared to furnish to their customers.

Pinion Rods and Cold Drawn Shapes.—A booklet issued by A. B. & J. Rathbone, Palmer, Mass., illustrating and describing their cold drawn pinion rods and special shapes of any desired form and size from which to make parts for the following machines and articles: watches, clocks, typewriters, multigraphing machines, etc.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York Inc.

The month of June has been rather a disappointing one for the brass and copper industry. Up to the middle of the month, it was felt that the price of copper and zinc would remain firm, and probably advance to some slight extent. In view of that feeling, the manufacturers were slow to make any reduction in the price of fabricated metals. However, the market slumped off to some extent toward the end of the month, and the prices on brass and copper, sheet, rod, etc., were reduced, another ¾c. per pound on brass products, and ½c. per pound on copper products, with the exception of seamless tubing, which was not changed. There has been a noticeable feeling of hesitancy on the part of many buyers, in the direction of making any new commitments, pending new developments which would indicate what the future course of business is likely to be. This has been interpreted by some people, as meaning that we were likely to run into a serious slump, but the best minds of the metal industry, seem to agree that as yet there is nothing in the situation to arouse a very strong feeling of pessimism.

One of the noticeable factors in the situation is the absence of the usual crop of cancellations that have been so common to falling markets in the past. There has been practically no complaint on this score from any of the manufacturers, and as far as can be learned, the number of cancellations has been exceedingly small. This can be interpreted as meaning that the orders that were placed on the rising market were very definite commitments, and that comparatively few orders were placed for speculation. It is felt that the general business conditions are sound and there will shortly be a resumption of buying, on the part of consumers. Deliveries are still slow, but there is of course some improvement over what they were a month ago. Some mills report that during June orders were equal to shipments, and are expected to increase.

In other branches of the metal business, such as nickel and Monel metal, there has been an extremely heavy demand, and a number of new lines of industry have adopted these metals as part of their equipment. The processes for their fabrication have been greatly improved, and metal of high quality has been produced in a commercial way in large quantities. A revised price schedule on Monel metal sheets has been made to become effective July 1st. Up to this time, Monel metal sheets of all gauges have sold at the same price, but on the new list of extras the lighter gauges are figured at an advance over the heavier sheets, and the base price is reduced from 45c. per lb. to 42c. per lb., f. o. b. Huntington, West Va. This change makes for a reduction in price of some of the heavier sizes, and an advance in the price in lighter gauges.

A general canvass of the trade indicates that all the nonferrous metals such as brass, copper, Monel metal and nickel are being consumed in very large quantities, and the producers confidently expect a heavy resumption of buying.

Metal Market Review

Written for The Metal Industry by METAL MAN

COPPER

The tone of the copper market during the last 30 days was easy for part of this period and again fairly steady for days at a time. Some substantial sales for both domestic delivery and export were made in the first half of the month at 14⅞ to 15 cents. A slightly firmer tendency developed later and producers succeeded in booking orders at 15 to 15⅛ cents.

Added to buying at the maximum figures there was also a moderate tonnage disposed of on the refinery basis of 14½ to 14¾ cents owing to the shaking out of some weakly held metal. As the month of June closed purchases tapered off to such an extent that market dullness became pronounced features of the situation.

It is of particular interest to note that the entire quantity of the original 400,000,000 pounds of export surplus copper has been sold by the Copper Export Association. The statistical posiion of copper is therefore much stronger than it was some months ago.

The June ending and the July opening of the market, however, was particularly depressed and quiet. Buying in large quantities is conspicuously absent and the market is easy at 14¾ to 15 cents, with the possibility that in some quarters these figures would be shaded.

ZINC

The sagging tendency of this market was the feature in recent weeks. Recent pronounced pressure to sell prompt and early shipment on the part of producers failed to create the amount of buying desired. Demand has been dull and disappointing and consumers in the light of present developments believe they are justified in following a conservative policy. The foreign situation has also been unsatisfactory and there is some talk of curtailing output by the Belgian producers. Ore production is being decreased at some of the domestic mines as profits are difficult for certain companies on the basis of present prices. Prompt shipment quotes 6.10 cents New York and 5.75 to 5.80 cents E. St. Louis.

TIN

The tin market continued its downward tendency during June as a result of general trade dullness and the indifference of consumers. Holders have also been anxious to realize on shipments coming due in July and August, but the stagnation of demand recently has made it difficult to dispose of stocks on a substantial scale. London operators on the "bull" side of the market lost their nerve lately and prices faded away as the artificial props crumbled. The end of June witnessed pronounced weakness in the New York, with Straits tin on spot nominally 39⅛ cents and futures 38⅞ cents. The July opening in the London market was specially weak. The market here is weak and unsettled, with a confused and downward tendency.

LEAD

Slack buying, free offerings and a downward tendency have been recent outstanding features in the lead market. The leading producing interest made two reductions in price during June, the latest recession bringing the New York basis down to 6.85 cents. There have been six reductions in price by the American Smelting & Refining Co. since March 3, representing a total decline of 1.40 cents per pound. Since the beginning of 1922 to March 3, 1923, the official price was advanced 26 times, namely from 4.70 to 8.25 cents. Heavy sales were made on each advance. The market faces new conditions at present, with competition looming up from foreign sources which makes the immediate outlook more or less uncertain.

ALUMINUM

The market for aluminum is more or less nominal as the article is under apparent definite control. Demand is quiet in

the open market, but a large share of the business is effected through private arrangements with consumers by the leading domestic producer. Offers of foreign metal are becoming less of a factor than formerly, and under these conditions and with light stocks here selling prices of foreign production are quoted at 27 to 27½ cents for 99 per cent plus and 26½ to 27 cents for 98-99 per cent. Recent exports of American plates, sheets, bars and rods have been heavy. This is considered significant and suggestive.

QUICKSILVER

The quicksilver situation shows no particular change and the New York market is quoting $67.50 to $68 per flask of 75 pounds. Strength in London was indicated by recent quotations of £10.15s., but it did not affect this market in a pronounced way as stocks here are said to be ample for present demand.

PLATINUM

There is no feature in the platinum market unless the continued firmness of prices which are maintained at $116 per ounce. Total purchases of crude platinum reported by refiners, including domestic and foreign, in 1922, amounted to 64,540 ounces. Stocks of platinum in hands of refiners at the end of 1922 were 41,900 troy ounces, compared with 38,514 ounces at the end of 1921.

SILVER

World market silver prices show a somewhat easier tendency recently, but this is not surprising in view of the termination of government purchases under the Pittman Act. With this supporting factor removed American silver companies must now meet the competition of foreign product in an open market. Producers may resort to storing silver in the hope of obtaining substantially higher prices eventually. The most important demand comes from China and India, but it is not possible to say that the requirements of the Orient will be sufficient to maintain the market around the present level. Mexico and Canada have been producing on a liberal scale and domestic companies will encounter active competition from these sources of supply. World consumption is said to be in excess of supplies from all sources. If this is so present values should not suffer a serious slump.

ANTIMONY

Trading conditions have been quiet for several weeks owing to light demand. China shippers offer with reserve and are disposed to be firm, but buyers hesitate to pay full figures of 7 cents duty paid in the face of the ease which has developed in other metals. There is, however, some inquiry for futures and the tone is fairly steady at 6.90c to 7c for Chinese regulars of 99% fine.

OLD METALS

The downward movement in new metals has thrown the market for scrap metals into a condition of pronounced dullness and weakness. Apathy is prevalent throughout the trade and buyers and sellers are too far apart in their views to permit of general activity. There is no aggressive buying possible on a falling market, and any pressure to sell means a definite recession in prices. Consumers are not inclined to buy on a large scale while the prospect is obscured. Buying prices are quoted at 9½c to 10c for light copper, 11¾c to 12c for strictly prime crucible copper, 4¾c to 5¼c for light brass scrap, 8½c to 8¾c for new brass clippings, 5¼c to 5½c for heavy lead, and old zinc scrap 4c to 4⅛c.

WATERBURY AVERAGE

Lake Copper—Average for 1922, 13.844—January, 1923, 14.875—February, 15.75—March, 17.25—April, 17.125—May, 16.125—June, 15.25.

Brass Mill Zinc—Average for 1922, 6.283—January, 1923, 8—February, 8—March, 8.70—April, 8.25—May, 7.60—June, 7.00.

Daily Metal Prices for the Month of June, 1923

Record of Daily, Highest, Lowest and Average Metal Prices for July 6, 1923

Date	1	4	5	6	7	8	11	12	13	14	15	18	19
Copper (f. o. b. Ref.) c/lb. Duty Free													
Lake (Delivered)	15.375	15.25	15.25	15.25	15.25	15.25	15.375	15.375	15.375	15.375	15.375	15.375	15.375
Electrolytic	14.875	14.875	14.875	14.875	14.875	14.875	15.00	15.25	15.25	15.25	15.25	15.125	15.125
Casting	14.625	14.625	14.625	14.625	14.625	14.625	14.625	14.75	14.875	14.875	14.875	14.75	14.75
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	6.50	6.40	6.40	6.35	6.30	6.25	6.20	6.15	6.15	6.10	6.00	6.00	6.00
Brass Special	6.60	6.55	6.50	6.50	6.45	6.40	6.35	6.30	6.30	6.20	6.15	6.15	6.10
Tin (f. o. b., N. Y.) c/lb. Duty Free													
Straits	41.75	41.50	41.875	41.95	42.50	42.25	42.00	42.00	41.875	41.375	41.00	40.50	40.25
Pig 99%	41.125	41.125	41.25	41.25	41.75	41.625	41.50	41.50	41.375	40.875	40.50	40.25	39.875
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	7.05	7.05	7.05	7.05	7.00	7.00	7.00	6.95	6.95	6.95	6.95	6.95	6.95
Aluminum c/lb. Duty 5c/lb.	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50	27.50
Nickel c/lb. Duty 3c/lb.													
Ingot—Internat. Nick. Co.	29	29	29	29	29	29	29	29	29	29	29	29	29
Outside Spot	29	29	29	29	29	29	29	29	29	29	29	29	29
Electrolytic (Internat. Nick. Co.)													
Ni.—99.80 contam. impur.—.14	32	32	32	32	32	32	32	32	32	32	32	32	32
Brit.-Amer. Nick. Corp.													
Ni.—98.50 contam. impur.—.80	30	30	30	30	30	30	30	30	30	30	30	30	30
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	7.00	7.00	6.95	6.85	6.75	6.75	6.75	6.75	6.75	6.75	6.75	6.75	6.85
Silver (foreign) c/oz. Duty Free	65.625	65.25	65.25	65.50	65.00	64.75	65.125	65.125	65.125	65.125	65.50	65.875	65.75
Platinum $/oz. Duty Free	116	116	116	116	114	114	114	114	114	116	116	116	116

Date	20	21	22	25	26	27	28	29	High	Low	Aver.	July 6
Copper (f. o. b. Ref.) c/lb. Duty Free												
Lake (Delivered)	15.25	15.125	15.125	15.125	15.125	15.125	15.00	15.00	15.375	15.00	15.244	14.875
Electrolytic	15.00	14.85	14.75	14.75	14.625	14.625	14.50	14.50	15.25	14.50	14.910	14.50
Casting	14.625	14.50	14.50	14.50	14.375	14.375	14.25	14.25	14.875	14.25	14.601	14.25
Zinc (f. o. b. St. L.) c/lb. Duty 1¼c/lb.												
Prime Western	5.95	5.90	5.80	5.80	5.80	5.80	5.80	5.80	6.50	5.80	6.069	5.90
Brass Special	6.10	6.00	5.95	5.90	5.90	5.95	5.90	5.90	6.60	5.90	6.198	6.10
Tin (f. o. b., N. Y.) o/lb. Duty Free												
Straits	40.75	40.125	40.50	40.75	40.375	39.50	39.40	39.125	42.50	39.00	40.998	37.75
Pig 99%	40.25	39.625	40.00	40.25	39.875	39.00	38.50	38.625	41.75	38.50	40.482	37.25
Lead (f. o. b., St. L.) c/lb. Duty 2½c/lb.	6.90	6.90	6.80	6.80	6.70	6.70	6.65	6.60	7.05	6.60	6.902	6.10
Aluminum c/lb. Duty 5c/lb.	27.50	27.50	27.25	27.25	27.25	27.25	27.25	27.25	27.50	22.25	27.429	27.25
Nickel c/lb. Duty 3c/lb.												
Ingot—Internat. Nick. Co.	29	29	29	29	29	29	29	29	29	29	29	29
Outside Spot	29	28	28	28	28	28	28	28	29	28	28.669	28
Electrolytic (Internat. Nick. Co.)												
Ni.—99.80 contam. impur.—.14	32	32	32	32	32	32	32	32	32	32	32	32
Brit.-Amer. Nick. Corp.												
Ni.—98.50 contam. impur.—.80	30	30	30	30	30	30	30	30	30	30	30	30
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	6.85	6.85	7.00	7.00	7.00	7.00	7.00	7.00	7.00	6.75	6.874	6.90
Silver (foreign) c/oz. Duty Free	65.25	64.25	64.50	64.125	64.125	63.875	63.875	63.625	65.875	63.625	64.887	63.375
Platinum $/oz. Duty Free.	116	116	116	116	116	116	116	116	116	114	115.524	116

Metal Prices, July 6, 1923

INGOT METALS AND ALLOYS

Brass Ingot, Yellow	11 to12½
Brass Ingots, Red	13½to15
Bronze Ingot	14 to16
Bismuth	$2.75
Cadmium	$1.00–1.05
Casting Aluminum Alloys	21 to24
Cobalt—97% pure	$2.75–3.00
Manganese Bronze Castings	22 to35
Manganese Bronze Ingots	13 to16
Manganese Bronze Forging	33 to42
Manganese Copper, 30%	28 to45
Magnesium Metal	$1.25–1.50
Parsons Manganese Bronze Ingots	20½to22
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	21½to26
Phosphor Copper, guaranteed 10%	21 to25
Phosphor Tin, guarantee 5%	48 to58
Phosphor Tin, no guarantee	46 to56
Quicksilver	$68
Silicon Copper, 10%.....according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
11¾to12¼	Heavy Cut Copper	12¾to13¼
11½to11¾	Copper Wire	12½to13
9½to 9¾	Light Copper	10¾to11¼
9¼to 9¾	Heavy Machine Comp.	11¼to11¾
6¾to 7¼	Heavy Brass	8¾to 9¼
5 to 5¼	Light Brass	6¾to 7¼
6¼	No. 1 Yellow Brass Turnings	7¼to 8¼
8¼to 8¾	No. 1 Comp Turnings	9½to10
4½to 4¾	Heavy Lead	5¼to 5½
2¼	Zinc Scrap	3¼to 3½
8¼to 8¾	Scrap Aluminum Turnings	10¾to11¼
14¼to14¾	Scrap Aluminum, cast alloyed	16¼to16¾
15¼to16¼	Scrap Aluminum, sheet (new)	17¼to18¼
22¼	No. 1 Pewter	26¼
13¾	Old Nickel anodes	15¼
21¼to23¼	Old Nickel	25¼to27¾

BRASS MATERIAL—MILL SHIPMENTS

In effect June 26, 1923

To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19¾	$0.21½	$0.23⅜
Wire	0.20¼	0.22	0.23⅞
Rod	0.18	0.22¼	0.24⅛
Brazed tubing	0.27¾	.....	0.33⅛
Open seam tubing	0.27¾	.....	0.33⅛
Angles and channels	0.30¾	.....	0.36⅛

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.20¾	$0.22½	$0.24⅜
Wire	0.21¼	0.23	0.24⅞
Rod	0.19	0.23¼	0.25⅛
Brazed tubing	0.28¾	.....	0.34⅛
Open seam tubing	0.28¾	.....	0.34⅛
Angles and channels	0.31¾	.....	0.37⅛

SEAMLESS TUBING

Brass, 25½c. to 26½c. per lb. base.
Copper, 27c. to 28c. per lb. base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod.....21¾c. net base
Muntz or Yellow Metal Sheathing (14"x48").....19¾c. net base
Muntz or Yellow Rectangular Sheets other than Sheathing.....20¾c. net base
Muntz or Yellow Metal Rod.....17¾c. net base
Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled).....23¾c. to 24¾c.
From stock.....24¾c. to 25¾c.

BARE COPPER WIRE—CARLOAD LOTS

18c. to 18¼c. per lb. base.

SOLDERING COPPERS

300 lbs. and over in one order.....22c. per lb. base
100 lbs. to 200 lbs. in one order.....22½c. per lb. base

ZINC SHEET

Duty, sheet, 15%. Cents per lb.
Carload lots, standard sizes and gauges, at mill, 8.90c. basis less 8 per cent. discount.
Casks, jobbers' prices.....10½c. to 11¼c.
Open casks, jobbers' prices.....11¼c. to 12¼c.

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga. and heavier, base price..... 37c.
Aluminum coils, 24 ga. and heavier, base price..... 35c.
Foreign ..... 45c.

NICKEL SILVER (NICKELENE)

Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	27c.	per lb.
15% "	28½c.	per lb.
18% "	29½c.	per lb.

Nickel Silver Wire and Rod

10% "	30c.	per lb.
15% "	33½c.	per lb.
18% "	36½c.	per lb.

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	40
Cold Drawn Rods (base)	48
Hot Rolled Sheets (base)	42

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 40 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 35 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over, 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Above prices f. o. b. mill.

SILVER SHEET

Rolled silver anodes .999 fine are quoted at from 60c. to 68c. per Troy ounce, depending upon quantity.

Rolled sterling silver 63½c. to 65½c.

NICKEL ANODES

85 to 87% purity	31½c.-34c. per lb.
90 to 92% purity	34c.-35c. per lb.
95 to 97% purity	36c.-37c. per lb.

Supply Prices, July 6, 1923

CHEMICALS

In Commercial Quantities—New York Prices

Acetone	lb.	.24½–.27
Acid—		
Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20 deg., Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., Carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.08
Nitric, 36 deg. Carboys	lb.	.06
Nitric, 42 deg. Carboys	lb.	.07
Sulphuric, 66 deg. Carboys	lb.	.02
Alcohol—		
Butyl	lb.	.35–.40
Denatured in bbls.	gal.	.38–.45
Alum—		
Lump, Barrels	lb.	.04
Powdered, Barrels	lb.	.04½
Aluminum sulphate, commercial tech	lb.	.02½–.03
Aluminum chloride solution	lb.	.22
Ammonium—		
Sulphate, tech., Barrels	lb.	.03¾
Sulphocyanide	lb.	.65
Argols, white, see Cream of Tartar	lb.	.27
Arsenic, white, Kegs	lb.	.16
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Blue Vitriol, see Copper Sulphate.		
Borax Crystals (Sodium Biborate), Barrels	lb.	.06
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.07
Chrome Green, bbls.	lb.	.39¼
Cobalt Chloride	lb.	—
Copper—		
Acetate	lb.	.37
Carbonate, Barrels	lb.	.20
Cyanide	lb.	.46
Sulphate, Barrels	lb.	.06½
Copperas (Iron Sulphate, bbl.)	lb.	.02
Corrosive Sublimate, see Mercury Bichloride.		
Cream of Tartar, Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05–.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	5.50
Gold Chloride	oz.	14.00
Gum—		
Sandarac	lb.	.26
Shellac	lb.	.82–1.00
Iron, Sulphate, see Copperas, bbl.	lb.	.02
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	1.15
Nickel—		
Carbonate Dry	lb.	.40
Chloride, 100 lb. lots	lb.	.22½–.40
Salts, single, bbls.	lb.	.11½
Salts, double, bbl.	lb.	.10½
Parrafin	lb.	.05–.06
Phosphorus—Duty free, according to quantity		.35–.40
Potash, Caustic, Electrolytic 88-92% fused, drums	lb.	.09
Potassium Bichromate, casks	lb.	.12
Carbonate, 80-85%, casks	lb.	.06
Cyanide, 165 lb. cases, 94-96%	lb.	.65
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Official	oz.	—
Rosin, bbls.	lb.	.03½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide	oz.	—
Nitrate, 100 ounce lots	oz.	.46
Soda Ash, 58%, bbls	lb.	.02½
Sodium—		
Biborate, see Borax (Powdered), bbls	lb.	.06
Cyanide, 96 to 98%, 100 lbs	lb.	.23
Hyposulphite, kegs	lb.	.04
Nitrate, tech. bbls	lb.	.03
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass) bbls	lb.	.02
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sugar of Lead, see Lead Acetate	lb.	.12–.13
Sulphur (Brimstone) bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.35
Tripoli	lb.	.03
Verdigris, see Copper Acetate	lb.	.37
Water Glass, see Sodium Silicate, bbls	lb.	.02½
Wax—		
Bees, white ref. bleached	lb.	.55
Yellow, No. 1	lb.	.35
Whiting, Bolted	lb.	.02½–.06
Zinc, Carbonate, bbls	lb.	.13–.17
Chloride, 600 lb. lots	lb.	.07
Cyanide	lb.	.37
Sulphate, bbls.	lb.	.03¼

COTTON BUFFS

Open buffs, per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base,	42.25
14 inch, 20 ply 64/68, cloth	base,	52.55
12 inch, 20 ply, 84/92, cloth	base,	51.05
14 inch, 20 ply, 84/92, cloth	base,	68.80
12 inch, 20 ply, 88/96, cloth	base,	58.35
14 inch, 20 ply, 88/96, cloth	base,	78.60
Sewed Buffs, per lb., bleached and unbleached	base,	.60

FELT WHEELS

		Price Per Lb. Less Than 100 Lbs.	300 Lbs. and Over
Diameter—10″ to 16″	1″ to 3″	2.75	2.50
" 6″ 8″ and over 16″	1″ to 3″	2.85	2.60
" 6″ to 24″	Over 3″	3.15	2.80
" 6″ to 24″	½″ to 1″	3.75	3.50
" 4″ to 6″	¼″ to 3″	4.75	Any quantity.
" Under 4″	¼″ to 3″	5.35	

Grey Mexican or French Grey—10c. less per lb. than Spanish, above. Odd sizes, 50c. advance.